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DEEP ATTACK MAP EXERCISE (DAME) GAME RULES and OPERATING PROCEDURES

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UNITED STATES ARMY COMBINED ARMS CENTER

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FORT LEAVENWORTH, KS 66027

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US Army Combined Arms Operations Research Activity

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Deep Attack Map Exercise (DAME)
Game Rules
and
Operating Procedures

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War Game, DAME Game Rules and Methodology, Combat Assessment, Interactive War Gaming, SCORES, TOE Force Development, Close Combat (Heavy) Mission Area Analysis.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Deep Attack Map Exercise (DAME) is a comprehensive, computer-assisted map exercise designed to game the significant aspects of the AirLand Battle for heavy forces. It was developed by the Combined Arms Operations Research Activity (CAORA) in response to a need for a quick-running low resolution wargame for use in the Close Combat (Heavy) Mission Area Analysis. Using a map board, a set of computer algorithms, and manual rules, the wargame attempts to portray the important aspects of the modern battlefield which must be considered in the AirLand Battle. These include: attrition, movement, logistics, and command and control.

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ABSTRACT

The Deep Attack Map Exercise (DAME) is a comprehensive, computer assisted map exercise designed to game the significant aspects of the AirLand Battle for heavy forces. It was developed by the Combined Arms Operations Research Activity (CAORA) in response to a need for a quick-running low resolution wargame for use in the Close Combat (Heavy) Mission Area Analysis. Using a map board, a set of computer algorithms, and manual rules, the wargame attempts to portray the important aspects of the modern battlefield which must be considered in the AirLand Battle. These include: attrition, movement, logistics, and command and control. This report documents the rules, operating procedures, and computer algorithms which were used in the map game. The rules and operating procedures are grouped according to their process (attrition, movement, etc.), and complete methodology and documentation is provided for all computer programs.

ACKNOWLEDGEMENTS

The Deep Attack Map Exercise (DAME) was developed as a quick-running war game for use in analyzing tactical and organizational concepts in the Close Combat (Heavy) Mission Area Analysis. DAME's success resulted from the efforts of many people. In particular, the authors wish to recognize the efforts of contributors from two principal agencies. First, the operations research analysts from CAORA were most helpful, including Ms. Mary Windeler, Mrs. Anne Keane, and Mr. Steve MacDaniel. The US Army Armor School, as proponents for the MAA and the operators of the game, were instrumental in both game development and execution. The authors wish to thank MAJ(P) Mike Lancaster, MAJ Scott Wallace, MAJ Ernie Przybyla, MAJ Dan Murphy, and CPT John Furman for their valuable assistance in the project.

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1. GAME OVERVIEW

a. General. The Deep Attack Map Exercise (DAME) is a comprehensive computer-assisted map exercise designed to game the significant aspects of the AirLand Battle Concept at the division level of resolution. It is a map-oriented game whose major components are a set of unit locations represented on a map and a set of computerized assessment algorithms, both governed by a set of manual game rules. This combination enables the gamers to maneuver, fight, and resupply units on the game board to portray the significant aspects of the AirLand Battle.

b. Processes. DAME represents the four processes which comprise the structure of combat: attrition, movement, logistics, and command and control. Each of these areas will be covered in detail in the game rules and process methodology. The significant areas considered are:

(1) Attrition:

- direct fire combat between 10 Red and 10 Blue systems
- indirect fire (including Copperhead)
- attack helicopters
- tactical aircraft
- minefields
- chemical attrition
- losses due to dismounted infantry combat

(2) Movement:

- movement times and rates for units based on terrain, vehicle type, barriers, and maintenance factors.

(3) Logistics:

- consumption, resupply, and movement of supply Class III and V
- battlefield repair times for damaged systems
- fuel and ammo supply point status

(4) C^3I:

- detection of battlefield units based on sensor availability and unit size and profile

• explicit control nodes and decision times for mission execution

• degradation of intelligence based on EW

c. General Features. When played at the Blue division/Red army level DAME has the general characteristics listed below.

(1) Unit Resolution.

(a) Combat units.	Red - Regiment/Battalion Blue - Battalion/Company
(b) Combat support.	Red - Battalion Blue - Battalion/Company
(c) Combat service support.	Red - Point Blue - Point

(2) Game Length. 48-72 hours are optimally played.

(3) Turn Length. 6 hours.

(4) Resources Required.

(a) Personnel.	2 Blue gamers 2 Red gamers 2 Controllers
(b) Material.	TEKTRONIX 4051 computer system Map board (1:50000) Secure game area Set of map symbols Input Sheets

(5) Gaming Manpower Requirements. Approximately 24 man-hours per 6-hour game turn.

(6) Number of units stored on computer. 40 Blue units, 80 Red units

(7) Systems Played.

Blue	Red
M1	T80
M2	BMP
M3	BTR
ITV	BRDM-2

Infantry
Command vehicle
Artillery piece
ADA vehicle
Truck (Cargo/POL)
Special purpose vehicle

(8) Units Played.

Combat (Armor, Infantry, etc.)
Artillery
ADA
AH Base/FARP
CP/HQ
Engineer Unit
Class III/V Supply Point
Maintenance Point
SAM Site
Commo/Radar Site

d. Game Flow. Proper preparation for gaming is critical to game validity. Scenario development, unit definition, unit positioning, and unit tactical missions must be determined and documented before initialization of unit files on the computer. After completing these preliminaries actual gaming may begin.

(1) Game Preparations.

(a) Position units on the game board.

(b) Develop and enter initial unit data into the computer.

(c) Run the detection program to develop initial intelligence map.

(d) Record initial game conditions.

(e) Print out the record of the status file and gamer work sheet.

(2) Game Play (Initial and Succeeding Game Turns).

(a) Red and Blue players move units based on movement and command and control rules.

(b) Complete gamer work sheets and enter unit data into computer for present game turn:

- unit missions
- sensor data
- mileage traveled by the unit
- Class III/V resupplied
- MOPP status
- returned equipment

(c) Run the logistics program to generate consumption of Class III/V for Red/Blue units.

(d) Allocate units to combat and prepare combat inputs.

(e) Assess combat, if required.

- ground
- indirect fire
- chemical
- develop and input losses from fixed wing aircraft

(f) Run the detection module to update intelligence map.

- make required changes to sensor array
- use the detection program to develop sensor detections
- run the detection program for unit recon patrols and air reconnaissance (if required)

(g) Update and print unit status at end of turn.

- unit effectiveness, Class III/V status
- print history and gamer work copies for the next game turn
- store turn results in the game history file
- document gamer actions for the game turn

(h) go to (a) and begin new game turn

e. The Wargamer and the Dynamics of Wargaming.

(1) These general remarks are primarily directed toward the wargamer. They address in general terms the creative aspects of wargaming. These aspects of gaming have been consistently overlooked and for that reason will be discussed here in explicit terms.

(2) The gaming process will primarily be determined by the scenario (i.e., played within the limits imposed by the conditions of the scenario), by the tactics available to the gamers, and by the constraints imposed by the controllers. The scenario, in essence, is the "script" by which the game is played. The scenario, the development of which begins the entire creative gaming process, must faithfully be recreated and played as intended by the

authors. To this end, the controllers guide the course of the gaming, adhering to the intent of the study. This is done by the skillful direction of the gamers, who develop tactics and implement the scenario on the map. The role of the controller, then, is crucial: h : impact must be minimal; his presence virtually transparent. His function must always be one of direction, rather than intervention. To intervene in an ongoing game is an indication that the controller has already lost control; to lose control may lead to the invalidation of the game. Thus, it goes without saying that the controller must be thoroughly familiar with the scenario. The controller must also take steps to insure that the gamers rely on "generalship" rather than "gamesmanship;" the latter implies the clever manipulation by the gamer of certain quirks and model anomalies of the game to his advantage. These "pseudo-tactics" may tend to skew and distort the gaming results.

(3) The gaming process itself is highly interactive from a personal standpoint. There exists a complex interaction and meshing of personalities: among the gamers, among the controllers, and among the gamers and controllers. Unfortunately, the function of "personality manager" generally falls upon the controller. This function is made all the more difficult because of the fact that gaming is by nature contentious and competitive. Gaming tends to evolve into a confrontation between individual egos; and generally between individuals who do not want to lose. This unique aspect of gaming often gives rise to situations that find gamers stretching the intent as well as the letters of the rules, i.e., an attempt to interject trickery into the game. Since gaming, by its very nature, can give rise to much heated discussion and debate, such trickery, or more often its misperception as cheating, can make the interpersonal environment intolerable. Thus the controller must always strive to maintain an atmosphere of cooperation and good will among many and diverse personalities.

(4) Often lost in the maze of numbers generated by wargames is the value of the gamer insights generated during the gaming process. Such insights by gamers can provide tremendous qualitative leverage in the solution of many of the overall analytical questions under study. To this end the controller must maintain a casual atmosphere of ongoing dialogue and discussion among the gaming participants, generating points of discussion and providing guidance as required. It is essential that these insights be documented as they occur, to prevent their loss in the later muddle of game compilation. Individual insights collected in this way can be consolidated at the conclusion of gaming. It is generally a good idea to conduct an informal game critique at the conclusion of a game turn.

(5) Care must be taken that the controller does not become overburdened and distracted by other tasks. A controller is not a computer operator, although he may be required to perform this task as a secondary function. By the same token the gamer is not merely a clerk required to fill out countless input sheets. Such tedium must be kept to a minimum as it degrades the creative aspect of gaming.

(6) The generation and use of military intelligence in the game to simulate closed play will have a profound impact on the entire process. The controller must consider the play of intelligence carefully and advisedly.

(7) At the heart of the entire gaming process resides the gamer. The gamer must be militarily knowledgeable; and foremost, he must be creative. There is a seldom acknowledged creative aspect of the military system that over the years has been the realm of military art. This especially relates to the intellectual dimension of the battlefield. The dynamics of the battlefield then become more than the apparent random movement of troops in combat. Like the careful selection of oils and their artful application upon canvas, or the creative orchestration of several musical instruments, the military commander creates success on the battlefield through the media of firepower, maneuver, command and control, information and logistics. However, it would be naive to expect that all gamers can maintain this view of gaming since it is by degrees far removed from the actual reality of the battlefield. One can only hope that the gamer view his participation as an opportunity to utilize the same creative thought processes that one would use in a real battle. Any other perspective quickly tends to make gaming a chore and the quality of gamer insights rapidly decline.

2. GAME OPERATIONS - INITIALIZATION AND COMPUTER OPERATIONS

a. General. As this document is intended to be a gamer's manual as well as a source document, explicit treatment will be given to computer procedures using the TEKTRONIX 4051 Computer System. Conversion to other systems will cause operating procedures to be modified, but the overall game structure should remain substantially unchanged.

b. Unit Data Sheet. Each of the playing units has a number of attributes which determine unit capability and status. The unit's status is maintained throughout the game on the computer and must be initialized by the gamer. A complete list of all unit attributes is given in Appendix A to this report. The Unit Data Sheet (Figure 2-1) is used by the gamer to develop an initial status for entry into the computer. An explanation of each of the blocks of the Unit Data Sheet follows.

(1) "UNIT #" - This is a simple numeric given to a playing unit. The number assigned must be unique and cannot be assigned to another unit. Blue units have numbers 1-40, while Red units are numbered 41-120.

(2) "NAME" - This is an alphanumeric name assigned to the unit. It may contain numbers as well as letters and is limited to 8 characters. This name is also unique to any given unit.

(3) "EQUIPMENT" - DAME plays 10 types of weapon systems within (assigned to) a given unit. The third line of the form consists of the equipment levels at the start of the game. Equipment totals may vary from actual TOE levels to reflect pregame attrition.

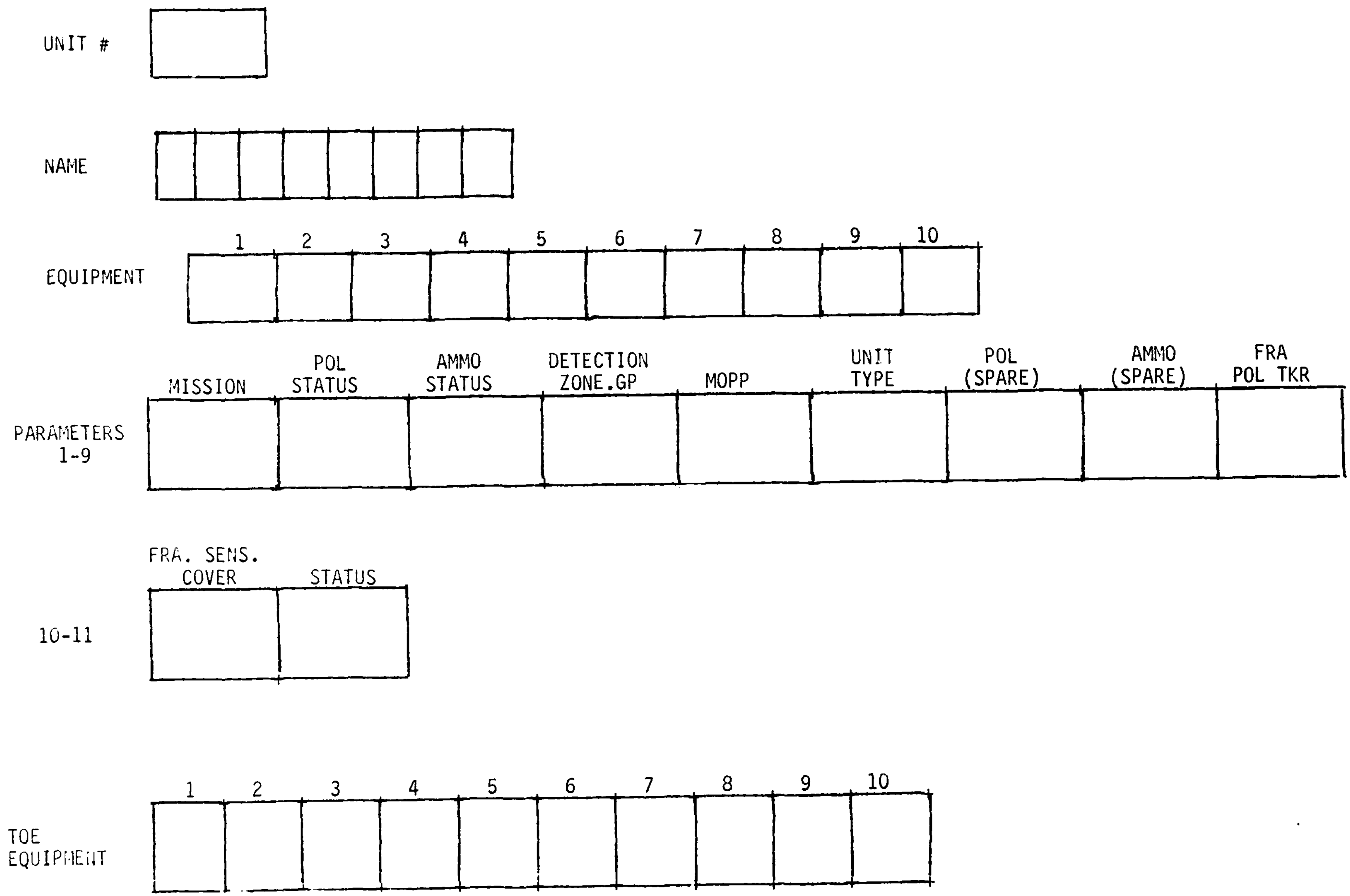

Figure 2-1. Unit Input Sheet.

(a) Block 1 - Number of M1s/T80s

(b) Block 2 - Number of M2s/BMPs

(c) Block 3 - Number of M3s/BTRs

(d) Block 4 - Number of ITVs/BRDMs

(e) Block 5 - Number of dismounted infantry. This number should consider only dismounted fighters and not IFV crews, TOW crewmen, etc.

(f) Block 6 - Number of command vehicles

(g) Block 7 - Number of artillery/mortar tubes. This figure represents the number of tubes/launchers for artillery units and the number of mortars for maneuver units.

(h) Block 8 - Number ADA systems (vehicular only)

(i) Block 9 - Number of POL/AMMO trucks

(j) Block 10 - Number of special vehicles. This number includes vans, radars, etc.

(4) "STATUS PARAMETERS 1-11" - There are several parameters or status attributes that are associated with each playing unit.

(a) "MISSION" - The mission defines the tactical status of a given unit and is used to define ammunition and fuel consumption rates. There are 10 tactical mission states. A mission is assigned in two 3-hour increments per game turn. It is important to include the decimal point when assigning the initial mission. The following tactical missions are available:

0 - Destroyed/combat ineffective

1 - Reserve

2 - Light defense

3 - Medium defense

4 - Heavy defense

5 - Light attack

6 - Medium attack

7 - Heavy attack

8 - Movement (1-40 kms)

9 - Movement (40-80 kms)

For example, mission 1.8 allows the unit to remain in a reserve status for 3 hours and then move in the next 3 hours.

(b) "POL STATUS" - This is the fraction of onboard POL within the battalion. For example, a battalion completely topped off would have a POL status of 1.0 (100% full).

(c) "AMMO STATUS" - This is the fraction of ammunition present on the unit's combat vehicles.

(d) "DETECTION ZONE - GP" - DAME plays unit detection (see Chapter 5). Certain parameters must be input to initialize the detection module. This input is in the format x.y where x is the distance of the unit from the FEBA in zone increments. These zones are:

1 - 0-3 km

2 - 3-12 km

3 - 12-25 km

4 - 25-100 km

5 - 100-200 km

Y relates to the principal sensor group being used to detect the unit. Groups 1-3 are particular sensor groups as described in Chapter 5, and 4 is used as the designation for units that are on their own side of the FEBA. For example 4.4 would define a unit that is 25-100 kms from the FEBA on the friendly side of the FEBA.

(e) "MOPP" - This parameter relates to the NBC protection status of a unit: 1 - the unit is not in MOPP or 2 - the unit is in MOPP 4.

(f) "UNIT TYPE" - Also in x.y format, this denotes the side (x) and type of a unit (y). The Blue side is denoted by 1 and the Red by 2. There are 10 exclusive unit types to select from:

0 - Combat

1 - Artillery

2 - ADA

3 - FARP/AH Base

4 - CP/HQ

5 - Engineer

6 - CL III/V supply point

7 - Maintenance point

8 - SAM site

9 - COMMO/EW radar unit

For example, a Red engineer unit would be designated as 2.5.

(g) "POL (SPARE)" - This relates to the amount of POL stored on the unit cargo vehicles. This is different and distinct from "POL STATUS" (2 above) which refers to POL on board the vehicles. POL aboard the unit trains is in gallons.

(h) "AMMO (SPARE)" - As above, but spare AMMO carried by the unit cargo vehicles in short tons (STONS).

(i) "FRA POL TKR" - This denotes the fraction of POL tankers contained in the total number of supply trucks entered in box (9) of the "EQUIPMENT" line. For example, if you had entered 10 supply trucks in box (9) and 5 of these are POL tankers then enter .50 as the tanker fraction.

(j) "FRA. SENS. COV." - Refers to the fraction of a given unit that could be covered by a sensor group. This fraction is based on gamer and controller judgment and takes into consideration movement, terrain coverage, combat status, unit type, level of attrition, etc.

(k) "STATUS" - Denotes whether a unit is inactive (0) or active (1) in game play. Inactive units are not considered in any phase of game play for attrition, resupply, or detection.

(5) "TOE EQUIPMENT" - List here the authorized TOE levels of the ten different equipment types for that unit. These values may not always agree, because of attrition, etc., with the values entered in the "EQUIPMENT" line. The TOE values are used to compute the combat effectiveness of the unit.

c. Computer System Operation. The following steps place the computer in operation, ready for game processing:

Power up system.

Place game disk in disk drive 0.

Start program execution by typing and entering the following commands:

```
INIT

CALL "SETTIM", "29-SEP-82 10:14" (enter proper date and time)

CALL "MOUNT", 0,Z$

OLD "DAME"
```

Upon executing RUN a menu of DAME programs will appear on the screen as shown in Figure 2-2. All program execution is controlled with this menu. Individual programs are written to automatically return to the program menu after successful execution. Any problems with program execution should be referred either to the computer operator or to the analyst for diagnosis and correction.

d. Game Initialization. The following steps must be completed in order to initialize the DAME data files for game operations.

(1) Use Program 10 to build the unit TOE file for all units played in the game. Data entry requirements include: unit number, side (Red/Blue), unit type, and a system count for systems 1-10. The TOE equipment of a unit reflects its full strength authorization and is used for calculating unit effectiveness. This program must be executed for all units prior to further game processing or computer errors will result.

(2) Use Program 2 to enter the unit equipment and status from the Unit Data Sheet. Option 5 within the program enters data from the unit sheet.

(3) Use Program 8 to create and initialize the game history file. An empty, formatted disk is required for this program. A separate disk is used for each game.

(4) Use Program 5 to generate the initial intelligence situation for the game. A detected target list for Red and Blue is generated by this program. Normally, a 12-hour intelligence cycle is used to generate the initial battlefield intelligence map.

(5) Use Program 6 to copy the initial game conditions to the history file and print out the initial gamer work copy. Initial game conditions are referred to as critical incident (CI) "00". The execution of this program completes the game initialization procedure. "Critical incident" and "game turn" are used synonomously throughout this report.

e. Game Turn Processing. The following sequence is used to process each game turn during actual game operations. As in the initialization process, menu-driven program selection (see fig 2-2) is used to access the various programs required for game operations.

DEEP ATTACK MAP EXERCISE
MENU

1. GROUND COMBAT MODULE
2. DATA ENTRY MODULE
3. CHEMICAL MODULE
4. LOGISTICS MODULE
5. DETECTION MODULE
6. GAME TURN SUMMARY MODULE
7. AIR LOSS ASSESSMENT MODULE
8. GAME PREPARATION MODULE
9. GAME POSTPROCESSOR MODULE
10. TOE FILE PREPARATION MODULE
11. SENSOR GROUP PREPARATION MODULE

ENTER DESIRED PROGRAM NUMBER

Figure 2-2. DAME Program Menu.

(1) Make a backup copy of the unit file (optional).

(a) Press BREAK key twice to abort menu program

(b) KILL "TEMPFILEO"

(c) COPY "UNITFILE", 0 TO "TEMPFILEO", 0

(2) Type and enter RUN (gives DAME master menu)

(3) Enter changes to logistics and detection data using Program 2 of the master menu. These changes are given to the computer operator by the gamers using the gamer work copy (explained in paragraph 2.f).

(4) After changes are complete create a backup file using Option 9 of Program 2.

(5) Use Option 1 of Program 2 to return to the master menu.

(6) Process logistics using Program 4. After Program 4 has executed the master menu will return. Press the BREAK key twice to abort the program.

(7) Make a backup copy of the UNITFILE (optional):

(a) Press BREAK key twice to abort menu program.

(b) KILL "TEMPFILE1"

(c) COPY "UNITFILE," 0 TO "TEMPFILE1", 0

(d) Type RUN to generate menu program.

(8) Process ground combat losses using Program 1 of the master menu. The program will return to the master menu when complete.

(9) Enter losses to aircraft using Program 7 of the master menu. Air losses are line 3 of the killer-victim table. The program will return to the master menu when complete.

(10) Process attrition due to chemical attack (if required) using Program 3 of the master menu. The program will return to the master menu when complete.

(11) Make a backup UNITFILE (optional):

(a) Press BREAK key twice to abort menu program.

(b) KILL "TEMPFILE2"

(c) KILL "CIDATA2"

(d) COPY "CIDATA ", 0 TO "CIDATA2", 0.

(e) COPY "UNITFILE ",0 to "TEMPFILE2 " 0.

(f) Enter RUN to return to the master menu.

(12) Redefine (if required) the composition of the Red and Blue sensor groups using Program 11 on the master menu.

(13) Process the detection assessments using Program 5 of the master menu. Make 2 copies of each detected list on the screen using the MAKE COPY key. Make a copy of the random number seed using the MAKE COPY key. The program will return to the master menu after execution.

(14) Make a backup copy of the UNITFILE (optional).

(a) Press BREAK key twice to abort menu program.

(b) KILL "TEMPFILE3".

(c) COPY "UNITFILE ",0 to "TEMPFILE3 ",0.

(d) Type RUN to generate menu program.

(15) Process CI summaries using Program 6 of the master menu. Insert the proper game data disk in Drive #1 on command. Insure the paper in the line printer is properly positioned to the top of the page before execution. The program will return to the master menu upon completion.

(16) Make a backup copy of UNITFILE (optional):

(a) Press BREAK key twice to abort menu program.

(b) KILL "TEMPFILE4".

(c) COPY "UNITFILE ",0 TO "TEMPFILE4", 0.

(17) This completes CI processing. If processing is complete for the day make a backup copy of the "DAME" disk as follows:

(a) Put backup disk in Drive #1.

(b) Enter:
```
CALL "MOUNT ",1, Z$
CALL "DRES ", 0
CALL "DRES ", 1
CALL "DUP ", 0, 1, 0
```

(18) Prior to powering down the computer clear the screen three times using the PAGE key.

f. Gamer Work Sheets and Records. To simplify gaming and the interchange between gamers and controllers a set of gamer work sheets have been developed to record gamer actions and for use by the computer operator. These game sheets are shown in this text in appropriate places and their use is explained. Therefore, only the name and a brief explanation of the form will be listed here.

(1) Sector Attrition Input Sheet. Used to define conventional combat between units by describing that type of combat, units, and battle conditions.

(2) Red and Blue Artillery Worksheets. Used to develop fire plans and artillery expenditures for use in the Sector Attrition Sheet.

(3) Red and Blue Attack Helicopter Worksheets. Used to develop and track use of attack helicoptersfor use in the Sector Attrition Sheet.

(4) Red and Blue Air Support Worksheet. Used to target units for attack by close air support sorties.

(5) Combat Support Input Sheet. Also called the "gamer work sheet," this form is used by the gamers to develop and record all non-attrition processes such as resupply, detection, mission status, and movement distances. This input sheet is a working copy of the unit status file and contains a listing of all unit non-combat attributes which can be changed by the gamer. Figure 2-3 shows a sample copy of this worksheet. Changes to a unit's status value are made by lining out the old entry and entering a new value. When completed by the gamer, this sheet is used by the computer operator to update a unit's status file for the game turn. A discussion of the entries on this form is given in appropriate sections of this paper.

(6) Unit Status Record. The unit status record is used to show a complete status for each unit in the game. It is generated at the end of each game turn for all units played on the computer. The status displayed is for the end of the game turn, and this status is used for gaming the next game turn. A sample of this output is shown in Figure 2-4.

(7) Game Summary. The game postprocessor (Program 9) provides summary statistics which detail movement distance, supply consumption, summary unit status, total kills, and a summary killer victim table. These statistics are useful for generating insights on gaming and the performance of units.

FOR CI #	8 UNIT	TYPE	MISSION	LOGISTICS --RESUPPLY-- AMMO	POL	DIST KM	ZONE	INTEL SENSOR GP	FRA COVER	STATUS HOFF	STATE	FRACTION POL TK	SUPPLY PT POL	AMMO
1	TF1-	1.00	2.2	0	0	26	1	4	0.70	1	1	0.357	0	0
2	TF1-	1.00	8.8	0	0	0	3	4	0.70	1	0	0.571	0	0
3	TF1-	1.00	8.8	0	0	0	2	4	0.70	1	0	0.357	0	0
4	TF1	1.00	2.2	0	0	26	1	4	0.70	1	1	0.357	0	0
5	TF1-	1.00	8.8	0	0	0	2	4	0.70	1	0	0.357	0	0
6	TF2-	1.00	8.8	0	0	0	3	4	0.70	1	0	0.571	0	0
7	TF4-	1.00	8.8	0	0	0	2	4	0.70	1	0	0.571	0	0
8	TF5-	1.00	2.2	0	0	28	1	4	0.70	1	1	0.571	0	0
9	1-	1.10	8.8	0	0	0	3	4	0.70	1	0	0.074	0	0
10	1-	1.10	8.8	0	0	0	2	4	0.70	1	0	0.074	0	0

Figure 2-3. Sample Combat Support Input Sheet.

```
CI STATISTICS FOR GAME 4  CI 07

 1  TF1-        1.00     MISSION:  2.2       MOFF: 1           STATUS: ***ACTIVE***
                EQUIPMENT:     4.1      13.5       1.9       3.9    115.8      5.1        0.8       0.0       7.1      10.6   CBT EFF: 0.35
                LOGISTICS: C/V STATUS:  FOL-0.77  AMMO-0.86   RESUPPLY:  FOL-     0  AMMO-     0  CONSUME:  FOL-  1476  AMMO-    8
                           FOL TRKS-  2.5    SPARE FOL-      0          AMMO TRKS-  4.5    SPARE AMMO-    0
                INTEL STATUS:  ACQ/VERIFIED   SENSOR FIELD:  1.4      SENSOR COVERAGE:  0.70    FOL FRA: 0.357

 2  TF1-        1.00     MISSION:  8.8       MOFF: 1           STATUS: INACTIVE
                EQUIPMENT:    30.0      26.0       7.0       0.0    194.0     10.0        6.0       0.0      21.0      28.0   CBT EFF: 1.00
                LOGISTICS: C/V STATUS:  FOL-1.00  AMMO-1.00   RESUPPLY:  FOL-     0  AMMO-     0  CONSUME:  FOL-     0  AMMO-    0
                           FOL TRKS- 12.0    SPARE FOL- 30000          AMMO TRKS-  9.0    SPARE AMMO-   75
                INTEL STATUS:  NOT DETECTED   SENSOR FIELD:  3.4      SENSOR COVERAGE:  0.70    FOL FRA: 0.571

 3  TF1-        1.00     MISSION:  8.8       MOFF: 1           STATUS: INACTIVE
                EQUIPMENT:    14.0      41.0       7.0      12.0    291.0     11.0        6.0       0.0      14.0      28.0   CBT EFF: 1.00
                LOGISTICS: C/V STATUS:  FOL-1.00  AMMO-1.00   RESUPPLY:  FOL-     0  AMMO-     0  CONSUME:  FOL-     0  AMMO-    0
                           FOL TRKS-  5.0    SPARE FOL- 12500          AMMO TRKS-  9.0    SPARE AMMO-   78
                INTEL STATUS:  NOT DETECTED   SENSOR FIELD:  2.4      SENSOR COVERAGE:  0.70    FOL FRA: 0.357

 4  TF1-        1.00     MISSION:  2.2       MOFF: 1           STATUS: ***ACTIVE***
                EQUIPMENT:     6.9      22.3       3.4       4.9    151.3      5.1        0.8       0.0      10.0      15.2   CBT EFF: 0.50
                LOGISTICS: C/V STATUS:  FOL-0.79  AMMO-0.96   RESUPPLY:  FOL-     0  AMMO-     0  CONSUME:  FOL-  1886  AMMO-    9
                           FOL TRKS-  3.6    SPARE FOL-      0          AMMO TRKS-  6.4    SPARE AMMO-    0
                INTEL STATUS:  ACQ/VERIFIED   SENSOR FIELD:  1.4      SENSOR COVERAGE:  0.70    FOL FRA: 0.357

 5  TF1-        1.00     MISSION:  8.8       MOFF: 1           STATUS: INACTIVE
                EQUIPMENT:    28.0      28.0       7.0      12.0    194.0     11.0        6.0       0.0      14.0      28.0   CBT EFF: 1.00
                LOGISTICS: C/V STATUS:  FOL-1.00  AMMO-1.00   RESUPPLY:  FOL-     0  AMMO-     0  CONSUME:  FOL-     0  AMMO-    0
                           FOL TRKS-  5.0    SPARE FOL- 12500          AMMO TRKS-  9.0    SPARE AMMO-   76
                INTEL STATUS:  NOT DETECTED   SENSOR FIELD:  2.4      SENSOR COVERAGE:  0.70    FOL FRA: 0.357
```

Figure 2-4. Sample Unit Status Record.

3. GAME OPERATIONS - ATTRITION.

a. General. This section covers the attrition processes which are played within the game structure. Of the 10 systems currently played on each side, seven are direct/indirect fire systems that can generate attrition. Dismounted infantry are represented by the firepower scores of the individual and light crew served weapons carried by the combat soldiers and by the antitank weapons (Rattler and AT-4) organic to the infantry platoon. Battle attrition is assessed in six range bands which cover 500 meter increments from 0-3000 meters. Movement through the successive range bands is determined by the gamer. In order to complete a direct fire attrition assessment in a given game turn, the combat forces in an area must be sectorized in order to determine the battle and fire support parameters. Each sector may be thought of as a distinct part of the overall battle. The direct fire worksheet aids in the assessment of combat and is discussed below.

b. Sector Input Sheet. Blue maneuver forces are listed on the battlefield as battalion-sized units while Red forces appear as regiments. Forces must be input into the battle with a unit code number and percentage fraction of the unit in contact with the enemy. The exact composition of a sector battle is determined by forces available and the terrain upon which the forces are arrayed. Sectors contain those units which fight in a battle under the same conditions. Units fighting under different conditions are put in different sectors. There may be many sectors of battle in a given game turn. Only those forces which can be directly involved in a battle during the course of a 6-hour critical incident can be included in the sector unit list. For example, a Red regiment could not attack on 200 meter front while in a narrow defile. Forces must be included only to the extent that they and their weapon systems can physically take part in the fight. Forces may not move and fight a battle in the same CI unless they can reasonably accomplish such a mission. Attacking troops can spend the entire CI (i.e. 6 hours) in the attack or the first 3 hours moving and the final 3 hours attacking. A total of five Blue and five Red units can be arrayed in any one sector. The heart of the DAME attrition module consists of the Sector Attrition Input Sheet (see Figure 3-1). The following is a step by step outline of the procedure necessary to complete the sheet. Beginning at the top of the sheet:

(1) Heading.

(a) "CI": Indicate the current CI.

(b) "GAME": Indicate the number of the current game.

(2) Unit Composition.

(a) "#": Indicate the unit ID number of the unit(s) arrayed in this battle sector. A total of five Red and five Blue units can be played in each sector.

CI:

SECTOR INPUT SHEET

GAME:

	#	FR	#	FR	#	FR	#	FR	#	FR
BLUE										
RED										

ROW	CI#	SECTOR #	0=RED ATK 1=BLUE ATK	MISSION: 1-MEETING 2-DELAY 3-W/DRAW 4-DEF·FORT 5-DEF·PREP 6-DEF·HASTY 7-I/FIRE ONLY	TERRAIN: 1-OPEN 2-ROLL 3-HILLY 4-MTN BLUE	RED	0-DISMTD 1-MTD	0-DAY 1-NIGHT	INITIAL RANGE BAND (1-6)	BARRIERS 0-NO 1-YES
1										

ROW	INF DISMOUNT? 0-NO 1-YES	LENGTH OF COMBAT (HRS) (1-6)	FINAL RANGE BAND (1-6)	FRA. BLUE FORCE COMMITTED (.0-1.0)	FRA. RED FORCE COMMITTED (0-1.0)	BLUE FATIGUE-MOPP DEGRADATION (0-1.0)	RED FATIGUE-MOPP DEGRADATION (0-1.0)
2							

ROW	MINES? 0-NO 1-YES	SECTOR WIDTH (m)	MINEFIELD WIDTH (m)	FRA. M/FIELD NOT BYPASSED (0-1.0)	FRA. FORCE ENTERING M.F (0-1.0)	BATTLE TYPE 1-CONV. 2-REAR AREA	VISIBILITY 1->5K ?-2K 2-5K 4-1K	FRA. BL ADA IN D/FIRE (0-1.0)	FRA RED ADA IN D/FIRE (0-1.0)	FRA RED ARTY IN D/FIRE (0-1.0)
3										

ROW	BLUE BTRY MISSIONS	ATK HELO SORTIES (BLUE)	BLUE CAS SORTIES	# CLGP MISSIONS	RED ARTY BTRY MISSIONS	RED ATK HELO SORTIES	RED CAS SORTIES	#BLUE BATTERIES	#RED BATTERIES	FRA. BLUE MISSIONS IN DS (0-1.0)	FRA. RED MISSIONS IN DS (0-1.0)
4											

Figure 3-1. Sector Attrition Input Sheet.

(b) "FR" Indicate the fraction of the sectorized unit that can physically be deployed in the battle sector.

(3) Sector combat parameters.

(a) Row 1.

1. "CI #": Indicate the current CI.

2. "SECTOR #": Indicate the sector number.

3. "RED/BLUE ATK": Indicate the attacking force in this sector.

4. "MISSION": Indicate the appropriate combat mission of the defending force.

5. "TERRAIN": Indicate the type of terrain occupied by Red and Blue forces. Four types are represented.

1 - Open: elevation changes of 0-50m per kilometer; scattered vegetation; good movement characteristics.

2 - Rolling: elevation changes from 51-200 meters per kilometer; near maximum cross country movement; varied vegetation.

3 - Hilly: elevation changes form 201-400 meters per kilometer; limited cross country movement by vehicle; varied vegetation.

4 - Mountainous: elevation changes greater than 400 meters per kilometer; poor cross country movement by any ground means.

6. "DISMOUNTED/MOUNTED": Indicate whether attacker is mounted (1) or dismounted (0). Defender is always considered dismounted.

7. "NIGHT/DAY": Indicate whether combat is taking place at night (1) or during the day. (0)

8. "INITIAL RANGE BAND": Battle range is considered in six range bands from 1-6 (0-3000 meters in 500 meter intervals). Direct fire combat is usually considered to begin at 3000 meters with no ambush tactics. This entry is a gamer judgment based on the current tactical situation. The final range band may be used as the initial range band in the next CI if the battle continues or modified as necessary (e.g., if the attacker retreated beyond the 3000 meter line).

9. "BARRIERS": Barriers impede movement and slow the rate of advance. Indicate if barriers are used by the defender.

(b) Row 2.

1. "INF DISMOUNT": Indicate if attacking infantry is dismounted.

2. "LENGTH OF COMBAT": Indicate the number of hours (1-6) that the battle is intended to last.

3. "FINAL RANGE BAND": A gamer input, based on a determination of how the attacker will close, or on a range at which the defender will withdraw. For example, if the initial range band of the battle is 6 (3000 meters) and the defender decides to withdraw at range band 4 (2000 meters), he inputs "4" in the box.

4. "FRA. BLUE FORCE COMMITTED": Both sides have the option of committing a percentage of that portion of the unit that is physically able to take part in the combat. For example, assume that Blue has .5 of a unit able to attack. He decides to commit only .5 of that portion for an effective commitment of (.5 x .5) 25% of the entire unit.

5. "FRA. RED FORCE COMMITTED": Same as 4. above but for Red.

6. "BLUE FATIGUE" Due to the effects of MOPP and continuous operations. Table 3-1 indicates degradation levels to be used based on the number of hours a unit has been in combat. Indicate the fraction by which the unit is degraded.

7. "RED FATIGUE": Same as 6. above but for Red.

(c) Row 3.

1. "MINES": Indicate whether the defender has mines emplaced; if "no" skip to 6.

2. "SECTOR WIDTH": Indicate the width (in meters) of the minefield in front of the defending unit.

3. "MINEFIELD WIDTH": Indicate the width (in meters) of the minefield. Depth is assumed to be 150 meters.

4. "FRA. M/FIELD NOT BYPASSED": This is the fraction of the minefield that cannot be bypassed by the attacking force.

5. "FRA. FORCE ENTERING M.F." This is the fraction of the attacking force which was unable to bypass the minefield and was forced to enter it in order to attack the defender.

6. "BATTLE TYPE": 1 - if the battle is conventional; and 2 - if the battle is in the defender's rear area.

7. "VISIBILITY": Indicate atmospheric visibility at the ranges specified.

Table 3-1.

PERFORMANCE DEGRADATION FACTORS

Degradation Due to MOPP 4

	Day 1	Day 2	Day 3
Blue Maneuver	.3	.5	.6
Artillery	.3	.5	.6
Red Maneuver	.3	.4	.5
Artillery	.4	.6	.7

Degradation for Fatigue and Combat Stress

DAYS SIDE: Attacker

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MANEUVER	0.0	.3	.48	.61	.68	.7	.71	.72	.73	.73	.74	.74	.74	.75	.75
ARTILLERY	0.0	.04	.09	.13	.17	.2	.22	.24	.26	.28	.3	.3	.3	.3	.3

DAYS SIDE: Defender

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MANEUVER	0.0	.22	.46	.51	.56	.58	.59	.6	.62	.63	.64	.66	.67	.68	.7
ARTILLERY	0.0	0.0	0.0	0.0	.15	.16	.18	.19	.21	.22	.24	.25	.27	.29	.3

Procedure

(a) Values indicate a fraction of unit degradation; e.g., Blue maneuver battalion in MOPP 4 for more than two days is reduced to an effectiveness of 40%.

(b) Only one performance degradation factor should be applied to a unit during a given period.

(C) SOURCE: Reference 63.

8. "FRA. BL ADA IN D/FIRE": Indicate the percentage fraction of Blue's ADA used in a direct fire role.

9. "FRA. RED ADA IN D/FIRE": Same as 8. but for Red.

10. "FRA. RED ARTY IN D/FIRE": Indicate the percentage fraction of the Red artillery allocated to this sector that is in a direct fire mode. These will most generally be Red 122 mm SP guns.

(4) Indirect Fire Inputs.

(a) "BLUE BTRY MISSIONS": The number of battery missions allocated to this sector battle. This figure is derived from the Blue Fire Support Worksheet and is described below.

(b) "ATK HELO SORTIES": Indicate the number of Blue attack helicopter sorties as derived from Attack Helicopter Sorties Worksheet as outlined below.

(c) "BLUE CAS SORTIES": Indicate the number of Blue close air support sorties from the CAS/BAI Sorties Worksheet.

(d) "# CLGP MISSIONS": Indicate the number of CLGP missions fired as indicated on the Blue Fire Support Worksheet.

(e) "RED ARTY BTRY MISSIONS": Indicate the number of Red battery missions for Red.

(f) "RED ATK HELO SORTIES": Indicate the number of allocated Red attack helicopters sorties.

(g) "RED CAS SORTIES": Indicate the number of Red CAS/BAI sorties allocated.

(h) "# BLUE BATTERIES": Denote the number of Blue batteries firing in support of this sector battle as indicated on the Blue Fire Support Worksheet.

(i) "# RED BATTERIES": Indicate the number of Red batteries firing.

(j) "FRA. BLUE MISSIONS IN DS": Indicate the fraction of direct support missions fired in this sector. The remaining fraction is used in a counterbattery role. The gamer has the option to choose whichever fraction is consistent with doctrine.

(k) "FRA. RED MISSIONS IN DS": Same as above but for Red.

c. Artillery. Artillery is played as a computerized assessment against direct fire systems and infantry formations as well as transport/ resupply systems. Artillery fire is generated in battery missions consisting of 48 rounds of 155 mm artillery for Blue and battery missions of 36 rounds of 152 mm for Red. These are the baseline systems for the artillery assessment module. All other calibers of Red and Blue are expressed as normalized equivalents of these baseline types of artillery and expressed in terms of a firing rate and a fractional lethality compared to the base systems. Equivalent rates (in the form of a multiplier) are shown in the indirect fire worksheets.

(1) Rules for Artillery Utilization.

(a) Artillery units are allocated as per the scenario and have range capability governed by performance specifications and tactical employment.

(b) Artillery is permitted to fire only when realistic physical space for battery deployment is available. FA units are not able to "pile" on one another or to be crowded into an unrealistic maneuver space.

(c) Maximum mission rates are listed in Table 3-2 (Artillery Mission Rates). Allocated fire missions cannot exceed maximum rates for any CI. Consecutive CI firing amounts will be limited to one-half the sustained rate unless the unit has been in position long enough to accumulate substantial stocks of ammunition.

(d) Movement of FA units will conform to movement rates established in Chapter 7 (Movement). FA unit movement is constrained such that full movement will degrade firing missions available by one half.

(e) Artillery fires are allocated only against targets in range of the firing batteries. Fires allocated for counterbattery, SEAD and CLGP missions are subtracted from the totals fired in direct support of maneuver units. Direct support fires may be allocated to different sectors if the sectors are in range of the firing battery, but the total missions may not exceed authorized firing rates.

(f) FA units are attrited by the attrition module.

(g) CLGP may be fired on a mission basis by FA units. Each mission requires two guns and reduces Blue artillery capability by .25 missions per CLGP mission.

(2) The Fire Support Worksheet. The Worksheet ties directly to the Sector Input Sheet. The data requirements and procedures are laid out below box by box (see Figure 3-2, the Blue Fire Support Worksheet or Figure 3-3, the Red Fire Support Worksheet):

(a) "CI": Indicate current CI.

(b) "SECTOR #": Indicate the sector to be supported by this "slice" of fire support.

	I-81	I55	8"	MLRS	TONS	120m	122	152	122MRL	220MRL	240m	203
1 - RESERVE	1.5	1	.5	.3	.5	1.5	1.5	1	.3	.1	1.0	1
2 - LT DEFENSE	9	5	2.5	1	2.4	11	8	6	2	1	5	4
3 - MED DEFENSE	17	8	4	1.5	3.8	16	11	9	3	1.5	10	6
4 - HVY DEFENSE	23	11	5.5	2	5.3	22	14	13	4	2	14	8
5 - LT ATTACK	6	5	2.5	1	2.4	6	5	4	1.5	1	4	2
6 - MED ATTACK	10	7	3.5	1.5	3.4	13	10	9	3	1.5	9	5
7 - HVY ATTACK	18	9	4.5	2	4.3	19	12	11	3	1.5	12	6
8 - MOVE ~40k	1.5	1	.5	.3	.5	1.5	1.5	1	.3	.1	1.0	1
9 - MOVE ~80k	1.5	1	.5	.3	.5	1.5	1.5	1	.3	.1	1	1

Table 3-2. Artillery Mission Rates.

SOURCE: Reference 2.

CI:

BLUE FIRE SUPPORT WORKSHEET

WEAPON	MULTIPLIER	SECTOR #			SECTOR #			SECTOR #			SECTOR #			
		#BTRY	#MSN	TOTAL	#BTRY	#MSN	TOTAL	#BTRY	#MSN	TOTAL	#BTRY	#MSN	TOTAL	
155mm	1.0													
203mm	1.0													
MLRS (PER BTRY)	4.5													
I-81 (PER BN)	0.4													
INDIRECT FIRE		TOT BTRY	TOT MSNS		TOT BTRY	TOT MSNS		TOT BTRY	TOT MSNS		TOT BTRY	TOT MSNS		
CLOSE AIR SUPPORT														
ATTACK HELOS														
CLGP MISSIONS														

Figure 3-2. Blue Fire Support Worksheet.

CI:

RED FIRE SUPPORT WORKSHEET

WEAPON	MULTIPLIER	SECTOR #			SECTOR #			SECTOR #			SECTOR #			
		#BTRY	#MSN	TOTAL	#BTRY	#MSN	TOTAL	#BTRY	#MSN	TOTAL	#BTRY	#MSN	TOTAL	
152mm	1.0													
122mm	0.7													
122 MRL (PER BTRY)	2.5													
220 MRL	4.0													
203mm	1.2													
120 MTR	0.6													
240 MTR	1.0													
INDIRECT FIRE		TOT BTRY	TOT MSNS		TOT BTRY	TOT MSNS		TOT BTRY	TOT MSNS		TOT BTRY	TOT MSNS		
CLOSE AIR SUPPORT														
ATTACK HELOS														

Figure 3-3. Red Fire Support Worksheet.

(c) "#BTRY": Indicate the number of batteries by the firing weapon system indicated in the "WEAPON" column.

(d) "#MSN": Indicate the number of missions to be fired by this weapon system as provided for in the Artillery Mission Rate Table.

(e) "TOTAL": This indicates the total effective battery mission equivalent. This is determined as follows:

1. Multiply the value in box "#BTRY" by the value in box "#MSN" and by the value in the "MULTIPLIER" column of the appropriate artillery system. This product is then placed in box "TOTAL".

2. For example, a gamer fires two batteries of 155 mm artillery in a heavy attack mode. The value for box "TOTAL" is derived as follows: 1.0 (multiplier value) x 2 (number of batteries) x 4.3 (effective mission rate) = 8.6 (total).

(f) "TOT BTRY": This is the summation across all artillery systems of the number of firing batteries in that sector.

(g) "TOT MSNS": This is the summation across all artillery systems of the number of fire missions called for in that sector.

(h) "CLOSE AIR SUPPORT": Indicate the number of CAS/BAI sorties for this sector as determined on the CAS/BAI Allocation Worksheet.

(i) "ATTACK HELOS": Indicate the number of Attack Helicopter sorties for this sector as determined on the A/H Allocation Worksheet.

(j) "CLGP MISSIONS": Indicate the number of CLGP (Blue only) missions fired in that sector.

d. Attack Helicopters. Attack helicopters are flown by Red and Blue gamers and can be targeted against direct/indirect fire systems and CS/CSS targets. The following rules apply:

(1) Sorties per game turn may be allocated against the number of available attack helicopters according to the following sortie formula:

# of A/H sorties = # A/H available x 1.3.

A maximum of six A/H sorties may be flown daily by an attack helicopter (max number of sorties = 6 x number available). The Attack Helicopter Allocation Worksheet (see Figure 3-4) is used to tabulate the number attack helicopters available in a given sector battle. The procedure used to complete this form is self-explanatory.

RED ATTACK HELICOPTER

BLUE SORTIES

GAME: CI:

UNIT	# A/H ALIVE	# SORTIES	REMARKS

Figure 3-4. Attack Helicopter Allocation Worksheet.

(2) Attack helicopters are attrited according to the level of air defense encountered in the target area. A maximum of 15% of the attack helicopters may be attrited per CI. Helicopters may be replaced after 12 hours if reasonably available. The number of helicopters currently available will be displayed on A/H unit symbols.

(3) Red/Blue attack helicopters are employed only within a radius of employment of 150 km for Blue and 125 km for Red.

e. Close Air Support. Close Air Support/Battlefield Air Interdiction (CAS/BAI) attrition is assessed manually. Air sorties are generated within scenario constraints. Air sorties are directed only at units whose status is maintained on the computer. Sorties flown against other targets such as LOCs, bridges, airfields, etc. are not explicitly assessed, but neither can they be diverted unrealistically against frontline units to increase kill rates.

(1) Figure 3-5 (see the CAS/BAI Allocation Worksheet) is used to determine available CAS and BAI sorties available for each sector. Its function is self-explanatory.

(2) Close air support systems are attrited off-line with the kill rates being attributed to each type of attacking aircraft. Sortie rates generated in the scenario must be realistically limited by the number of aircraft available, mission capacity, refuel/rearm time, and combat radius. These rates must be allocated on a priority basis to sector battles within the division area.

(3) Ground losses will be manually assessed according to parameters listed in the Air-Ground Loss Tables, Tables 3-3 and 3-4. The game controllers will apportion those losses to the units which were attacked by strike aircraft. Modification to the losses in the table is acceptable if it realistically portrays the battlefield situation.

(4) Blue close air support is flown by three basic types of aircraft: A-10 Thunderbolt II, F-16/A-7 and B-52. A-10 and F-16/A-7 aircraft must be flown in flights of two aircraft, while B-52 strikes are flown in "cells" of three aircraft. The losses given in the Blue Air-Ground Loss Table (Table 3-3) assume that the A-10 will carry Maverick missiles and 30mm cannon, while F-16/A-7 aircraft will carry Maverick missiles only. B-52 aircraft deliver either conventional bombs or air delivered Gator mines.

RED CAS/BAI

BLUE SORTIES

GAME: CI:

# SORTIES	TYPE	ARMAMENT	TARGET #	REMARKS

Figure 3-5. CAS/BAI Allocation Worksheet.

Table 3-3. Blue Air-Ground Loss Table.

TYPE AIRCRAFT	LOSSES VEHICLES	LOSSES PERSONNEL
A-10	3	8
F-16/A-7	2	5
B-52 (per cell)	1	16

(5) Red close air support is delivered by the Frog Foot, Flogger, Fitter and Fencer aircraft. The same assumptions apply as with Blue regarding attrition, availability, loss apportionment, etc. All Red aircraft are assumed to deliver tactical air-to-surface munitions (TASM) except the Frog Foot which delivers TASM and 30mm cannon fire. The loss rates of Table 3-4 apply:

Table 3-4. Red Air-Ground Loss Table.

TYPE AIRCRAFT	LOSSES VEHICLES	LOSSES PERSONNEL
Frog Foot	2.4	6
Flogger	1.5	4
Fitter	1.5	4
Fencer	1.5	4

SOURCE: Reference 30.

(6) Since losses to close air support aircraft are manually determined they may be directly applied to any units which are maintained in the history file. Program 7 on the DAME menu allows any unit to be accessed and its forces decremented by pre-determined losses. In this way losses to aircraft may be tracked without the requirement for all units to participate in sector battles.

f. Recap. The following recapitulation is provided to assist the gamer in developing entries for the Sector Attrition Input Sheet. It is important that the gamers view the entire attrition input cycle as a sequential, step-by-step process. In this way the initial tendency to be overwhelmed by the paperwork will be minimized. The following order should be maintained in completing the attrition input sheets.

(1) The gamers should begin the attrition input cycle by first putting units into sectors and deciding which units will be attrited by combat.

(2) Air sorties are then allocated using the CAS/BAI Worksheet.

(3) Attack helicopters are then allocated using the A/H Allocation Worksheet.

(4) Artillery is then allocated using the Red and Blue Fire Support Worksheets.

(5) Finally the basic input data arrived at in the previous steps can now be transferred to the appropriate boxes on the Sector Attrition Input Sheet and the sheet itself can be completed.

(6) Completed sector input sheets are then given to the controller for assessment using the computer routines.

g. Attrition Results. Attrition results are displayed after the processing of each sector battle. The results sheet shown at Figure 3-6 shows the format used. Each results sheet summarizes unit and combat inputs, initial and surviving forces, and a killer-victim matrix used by category. Killer-victim values for individual weapons are not available. A summary killer-victim table for the entire game turn is generated with the game turn summary program (Program 6 on the DAME menu).

h. Chemical Attrition. Attrition of Red and Blue forces due to chemical warfare is played in DAME using a separate attrition program. However, it is important to realize that chemical attrition is not a separate process but must be integrated into the overall loss assessment process used in the game.

```
SECTOR 2.1 RESULTS

SECTOR PARAMETERS

   2.10      1.00      6.00      3.00      3.00      1.00      0.00      6.00      1.00      0.00
   0.00      0.00      0.34      3.00      0.17      4.00      0.50      0.60      0.00      0.00
   1.00   2000.00    500.00      0.30      0.25      0.00      1.00      3.00      0.00      0.00

INDIRECT FIRE PARAMETERS
 18.0     0.0     0.0     0.0     0.0     0.0     0.0     2.0     0.0   100.0

ATKR/DEF FORCE RATIO:  0.3 : 1
ADVANCE RATE (KM/HR):   0.0
TOTAL ADVANCE (KM):   0.0

UNITS
  8.00    0.50   12.00    0.50    0.00    0.00    0.00    0.00    0.00    0.00
117.00    0.50    0.00    0.00    0.00    0.00    0.00    0.00    0.00    0.00

BLUE/RED LOSSES
  43.5   13.0    7.0    0.0   92.0   10.0    6.0    0.0   21.0   28.0 —— Initial Blue Forces
  35.9   10.8    4.7    0.0   72.2    8.7    6.0    0.0   19.6   26.1    Surviving Blue Forces
  17.0    0.5    1.5    0.0    0.0    1.5    0.0    2.0   22.5   21.5    Initial Red Forces
   7.8    0.4    1.0    0.0    0.0    1.0    0.0    1.7   16.0   11.4    Surviving Red Forces

BLUE KILLER-RED VICTIM
   8.7    0.1    0.5    0.0    0.0    0.3    0.0    0.0    5.4    2.0
   0.4    0.0    0.0    0.0    0.0    0.2    0.0    0.3    1.2    8.2
   0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0
   0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0
   0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0

RED KILLER-BLUE VICTIM
   7.6    2.2    2.3    0.0   19.8    1.3    0.0    0.0    1.4    1.9 —— Direct Fire Kills
   0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    Indirect Fire Kills
   0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    Tac Air Kills
   0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    Atk Helicopter Kills
   0.0    0.0    0.0    0.0    0.1    0.0    0.0    0.0    0.0    0.0    Mine Kills
```

Figure 3-6. Sample Sector Attrition Results.

The chemical munitions used in DAME are artillery or rocket delivered, and are measured in battery (48-round) or battalion (144-round) missions. The model allows Red and Blue forces to deliver either persistent or non-persistent agents against enemy forces. The use of chemical munitions must be integrated into the artillery fire planning process, and use of chemical munitions must not exceed prescribed firing rates, range requirements, or basic loads. Chemical missions replace conventional missions in the overall firing profile of an artillery unit. An artillery unit may not exceed its conventional rate of fire or basic load.

(1) Chemical Input Sheet. As with other modules, an input sheet has been developed to simplify the development of chemical attrition assessments. Figure 3-7 shows an example of the form. The following paragraphs describe the required inputs.

(a) Type of Mission. Circle the type of mission desired. A separate input sheet is required for each individual mission type. For example, if the gamer desires to shoot Red battalion missions of persistent agent and Blue battery missions of non-persistent agent, two separate input sheets are required.

(b) Number of Targets. Enter the number of units which will be targeted by a particular type of mission. A target may only have one unit in it. A maximum of 10 targets may be designated for a mission type. If the gamer desires more than 10 targets an additional input sheet must be used.

(c) Target Data Matrix. Information on each target is specified by entering:

1. The unit number of the target (1-120).

2. The fraction of the unit which is affected by the mission. For example, if only half of a unit is in the target area, then .50 is entered.

3. The number of missions which will be fired against the target.

4. The MOPP status of the target unit (1=not in MOPP, 2=in MOPP 4). Units which are in MOPP do not sustain casualties from chemical attack.

(2) Chemical Attrition. Assessments are made for chemical attrition using Program 3 of the DAME menu. This program uses the input sheet for data entry and reports the amount of casualties as they are assessed.

DAME CHEMICAL MODULE

GAMER INPUT SHEET

A. Circle one of the following:

(1) Red Battery of Persistent

(2) Red Battery of Non-persistent

(3) Red Battalion of Persistent

(4) Red Battalion of Non-persistent

(5) Blue Battery of Persistent

(6) Blue Battery of Non-persistent

(7) Blue Battalion of Persistent

(8) Blue Battalion of Non-persistent

B. Enter number of units to assess as targets for the above mission (max 10). ____________

C. Fill in the table with the following information for each target selected:

UNIT - A legitimate unit number from the unit file.

FRACTION - Fraction of unit affected by mission.

MISSIONS - Number of mission assessments against unit.

MOPP - MOPP status (1 = Not in MOPP, 2 = In MOPP)

TARGET	UNIT	FRACTION	MISSIONS	MOPP
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Figure 3-7. Chemical Input Sheet

4. GAME OPERATIONS - COMMAND AND CONTROL.

a. General.

(1) The command and control processes in DAME represent the ability of Red and Blue commanders to control their units in response to the battlefield situation and perceived enemy actions. The control process can be represented as a closed loop containing three continuously repeating phases:

(a) Receipt of data on the position and state of controlled units, the battlefield, and the enemy.

(b) The adoption or modification of a decision concerning the action of controlled units.

(c) Transmission of commands to the controlled units.

(2) Two functions are required of the controlling unit (headquarters):

(a) Decision - which consists primarily of analysis and the evaluation of the situation and generation of an order.

(b) Execution - which consists of the transmission and execution of required orders.

(3) Troop control consists of two groups of measures:

(a) The first group contains measures directly connected with organization of the operation (battle): the study of data on the enemy and disclosure of enemy intentions, a prompt decision to conduct an operation (battle) and modification of this decision during the course of combat operations, assignment of combat missions to the troops, organization and maintenance of coordinated troop action.

(b) The second group contains measures directed toward implementation of commander decisions and the creation of favorable conditions for friendly troop actions: preparation of troops for combat; organizaton of reconnaissance; organization of troop protection against mass destruction weapons; organization of camouflage and concealment, security, headquarters internal administration, engineer, resupply, technical, medical, topographic-geodetic and weather-forecasting support; organization of control and communications posts; continuous monitoring of troop action and assistance to troops.

(4) The complexity and diversified nature of troop control processes are apparent from the above. With this in mind, DAME seeks to portray the above processes in a greatly simplified manner by providing the gamer a set of rules which will generate the amount of time required to perform the staff work necessary to implement those processes.

b. Procedure.

(1) In DAME an enemy unit is assumed to be in one of four detection states: undetected, detected, acquired and verified, or lost. A list of detected enemy units is provided to each gamer before each game turn. This list represents available intelligence to the unit commander for use in his order development.

(2) A unit is assumed to be in one of four mission states: attack, defense, move or reserve. These mission states affect the exposure profile of the unit and thus its ability to be detected.

(3) Once a unit has been detected or acquired and verified, and the gamer makes a command decision, a chain of order implementation procedures is assumed to be initiated at the required command echelon (army, corps, division, etc.). The order ripples down through successively lower echelons to the action unit which is to perform the mission. This ripple effect requires a specified amount of time to pass through each succeeding echelon. This specified time is termed "staff reaction and command implementation time."

(4) The length of time required at each echelon will largely be determined by:

(a) level of attrition

(b) weather

(c) side (Red or Blue)

(d) mission

(e) conventional or integrated battlefield

(f) relative unit proximity

(g) headquarters interdiction

(5) The detection status will be assessed every 3 hours.

c. Overview.

(1) At the start of every 3-hour time increment, each Blue battalion and Red regiment is assessed to determine whether or not it has detected the enemy.

(a) If a battalion/regiment does not detect the enemy, it continues with its previous mission.

(b) However, if the unit does detect the enemy, the gamer has the option of generating a new mission order.

(2) Staff and commander reaction times are listed in Tables 4-1 and 4-2.

(3) Given the mission selected and considering the state of the battlefield the gamer then references the tables to determine how much CI time was used to accomplish command and control tasks. This time is subtracted from total CI time, the remainder being time available to move and have combat.

(4) The commander reaction times are assumed to include times required for the following functions:

(a) Know the friendly and enemy situations.

(b) Make decisions.

(c) Assign missions.

(d) Allocate means.

(e) Direct the forces.

(f) Sustain the forces.

(5) The staff reaction time includes times required for the following functions:

(a) Collect information.

(b) Collate information.

(c) Analyze information.

(d) Disseminate information.

(e) Make plans.

(f) Issue and publish orders.

(6) The following example is provided to further clarify the command and control system.

	Cumulative (Incremental) Base Time		+ Weather Effects			+ Night	+ Attrition	+ Air Interdiction
Mission By Echelon	Conv.	Integ.	Good	Mod	Severe	1800-0600	Per 10%	If Received
Defend								
XXXX	90 (90)	270 (270)	0	0	0	10 (10)	0	20 (20)
XXX	150 (60)	450 (180)	0	0	15 (15)	20 (10)	0	40 (20)
XX	210 (60)	630 (180)	0	15 (15)	30 (15)	30 (10)	0	55 (15)
X	240 (30)	720 (90)	0	30 (15)	45 (15)	40 (10)	0	65 (10)
II	250 (10)	750 (30)	0	45 (15)	60 (15)	50 (10)	15 (15)	70 (5)
Move								
XXXX	100 (100)	300 (300)	0	0	20 (20)	15 (15)	0	20 (20
XXX	170 (70)	510 (210)	0	20 (20)	40 (20)	25 (10)	0	35 (15)
XX	235 (65)	705 (195)	0	40 (20)	60 (20)	40 (15)	0	45 (10)
X	270 (35)	810 (105)	0	60 (20)	80 (20)	50 (10)	0	50 (5)
II	290 (20)	870 (60)	0	80 (20)	120 (40)	65 (15)	20 (20)	50 (0)
Reserve								
XXXX	60 (60)	180 (180)	0	0	0	0	0	10 (10)
XXX	100 (40)	300 (120)	0	0	10 (10)	5 (5)	0	20 (10)
XX	140 (40)	420 (120)	0	0	20 (10)	10 (5)	0	25 (5)
X	160 (20)	480 (60)	0	10 (10)	30 (10)	15 (5)	0	25 (0)
II	210 (50)	510 (30)	0	20 (10)	40 (10)	20 (5)	0	25 (0)
Attack								
XXXX	120 (120)	360 (360)	0	0	30 (30)	45 (45)	0	90 (90)
XXX	200 (80)	600 (240)	0	25 (25)	60 (30)	90 (45)	0	150 (60)
XX	280 (80)	840 (240)	0	50 (25)	90 (30)	150 (60)	0	190 (40)
X	320 (40)	960 (120)	0	75 (25)	120 (30)	200 (50)	0	210 (20)
II	340 (20)	1020 (60)	0	100 (25)	150 (30)	260 (60)	30 (30)	220 (10)

SOURCE: Reference 30, 64.

Table 4-1. Staff and Commander Reaction Time (Blue)
-- Minutes --

	Cumulative (Incremental) Base Time		+ Weather Effects			+ Night	+ Attrition	+ Air Interdiction
Mission By Echelon	Conv.	Integ.	Good	Mod	Severe	1800-0600	Per 10%	If Received
Defend								
XXXXX	120 (120)	480 (480)	0	0	5 (5)	15 (15)	0	30 (30)
XXXX	240 (120)	960 (480)	0	0	10 (5)	30 (15)	0	60 (30)
XX	330 (90)	1320 (360)	0	0	15 (5)	45 (15)	0	80 (20)
III	370 (80)	1480 (160)	0	0	20 (5)	60 (15)	30 (30)	90 (10)
Move								
XXXXX	140 (140)	700 (700)	0	0	10 (10)	30 (30)	0	40 (40)
XXXX	260 (120)	1300 (600)	0	0	20 (10)	60 (30)	0	80 (40)
XX	350 (90)	1750 (450)	0	0	30 (10)	90 (30)	0	110 (30)
III	410 (60)	2050 (450)	0	0	35 (5)	120 (30)	45 (45)	135 (25)
Reserve								
XXXXX	90 (90)	360 (360)	0	0	0 (5)	5	0	5 (5)
XXXX	150 (60)	600 (240)	0	0	0 (5)	10	0	10 (5)
XX	180 (30)	720 (120)	0	0	0	15 (5)	0	20 (10)
III	210 (30)	840 (120)	0	0	0	20 (5)	20 (20)	20 (0)
Attack								
XXXXX	180 (180)	900 (900)	0	0	15 (15)	45 (45)	0	120 (120)
XXXX	300 (120)	1500 (600)	0	0	35 (20)	100 (55)	0	180 (60)
XX	450 (150)	2250 (750)	0	0	55 (20)	160 (60)	0	290 (110)
III	570 (120)	2850 (600)	0	0	85 (30)	230 (70)	60 (60)	290 (0)

Table 4-2. Staff and Commander Reaction Time (Red)
-- Minutes --

(a) Assume that a mission order to defend has been issued by a Blue Army commander. The battlefield is integrated with moderate weather conditions prevailing. It is night and the Blue battalion which will execute the order has been attrited 10%. The Blue battalion has also been interdicted by airstrikes.

(b) The gamer enters the Staff and Commander Reaction Time table at the "Mission by Echelon" column and locates the appropriate mission which is "Defend". Since the order has been given by Army and the battlefield is considered integrated, the gamer references the column headed "Integ" to determine cumulative base time for the transmission of the mission order from Army to the affected battalion. In this instance the total base time is determined to be 750 minutes (12.5 hours).

(c) Because of the moderate weather conditions, an additional 45 minute delay is imposed.

(d) The fact that it is night when the order was issued adds a further 50 minutes to the base time.

(e) Since the effecting battalion has been attrited by 10% and attacked by air, an additional 20 minute delay is imposed.

(f) The total time required for the order to pass from Army to battalion is:

750 minutes	(integrated battlefield)
45	(moderate weather conditions)
50	(night)
15	(battalion attrited 10%)
5	(air interdiction received at battalion)
865 minutes	(total order transit time) = 14.4 hours.

(g) In terms of the game flow, this essentially means that the battalion receiving a defend order under the specified conditions cannot execute it until nearly two CIs after the army issued it. This imposed delay structure provides for realistic unit reaction times.

5. GAME OPERATIONS - INTELLIGENCE.

a. General. The intelligence process in DAME is considered using the DAME detection module which provides both Red and Blue gamers with an intelligence "map" of units which have been:

(1) Detected - the location of the unit is known, but the unit size and type is not known.

(2) Verified - location, size and type of unit have been clearly identified.

(3) Lost - the status of unit becomes unknown after having been detected.

b. Detection Module. The detection module consists of a main program and 15 associated data bases. The program is used to generate target detection lists. The lists should be viewed as entries on the intelligence "map" for the Red and Blue Army commanders. The play of the intelligence map is entirely optional and should be used at the discretion of the controller. The detection module allows the user seven options:

(1) Begin game for Blue.

(2) Begin game for Red.

(3) Update the current target list at beginning of CI (Blue).

(4) Update the current target list at beginning of CI (Red).

(5) Update Blue intel for Blue units in contact.

(6) Update Red intel for Red units in contact.

(7) Update Red intel for Red commander using air reconnaissance.

c. Procedure. The detection module follows the same basic sequence for each option:

(1) The gamer selects one of the seven options.

(2) The data base representing the detection probabilities associated with that selection are called into memory.

(3) The module then opens the DAME unitfile and begins to process each unit on the file under the constraints imposed by the gamer selected option.

(4) Updated detection records are written back to the unit file as they are processed.

d. Methodology and Assumptions. Units are processed in a similar manner for options one through four. The module interrogates the unit file in 3-hour blocks. Units that are not covered by a sensor group are ignored. Those that are covered go through the following sequence:

(1) If the target is previously detected, then its movement clock is decreased by 3 hours representing an upcoming movement event.

(2) Otherwise, if the target is not detected or under a mission order to MOVE, or is moving to avoid detection then a detection probability is calculated. For options one and two the "calculation" of this probability is

simply a retrieval of appropriate value from the data base. For options three and four an extensive calculation is performed based on the sensor group covering the unit, the location of the unit, the signature of the unit and the number of elements in the unit. The resultant probability of detection is then degraded by the "fraction of messages jammed."

(3) If the unit is detected, the "detection (tracking) time" is increased by 3 hours.

(4) A comparison is then made between detection time and an arbitrary threshold of 4 hours. Units tracked continuously for more than 4 hours are assumed to be verified as to location and type.

(5) Units not detected this time but that were previously detected in the prior 3 hours are moved into a "lost" status. They will remain lost for the next 3 hours.

(6) The unit record is replaced on the unit file and the program proceeds to the next unit.

e. Selection of Detection Status. The above outline briefly described the technical processes that are required to implement the detection module. The detection module is fairly transparent to the operation of the game, so that the gamer need not overly concern himself with all the internal computational details. However, there are certain input requirements that are the responsibility of the gamer that will impact on detection.

(1) On the initialization input sheets the gamer should be aware that a mission of "MOVE" (mission 8 or 9) may help that unit avoid detection depending on its relation to the FEBA.

(2) The combat support worksheet is used to update unit detection status in each game turn (see Fig 2-2). The "INTEL" block of the form does this.

(a) "ZONE" refers to the distance of the unit from the sensor group which is attempting to detect it. The zones are:

1. 0-3 km

2. 4-12 km

3. 13-25 km

4. 26-100 km

5. 101-200 km

(b) "SENSOR GP" refers to the number of the sensor group attempting to detect the unit. Groups 1-3 are defined by the gamer (see below), while Group 4 is a generic group defined by the theoretical sensor coverage of a corps-sized unit.

(c) "FRA COVER" is the estimated fraction of a unit that is potentially "visible" to an enemy sensor group.

(3) As discussed below, the gamers have the ability as the game proceeds to change sensor groupings and send out patrols to verify detected units. The controllers will create new sensor groupings in consultation with the gamers.

(4) The detection module also plays an important role in the Command and Control routine. Essentially a gamer cannot react to a unit that has not been detected or verified.

f. Changes in Sensor Patterns. The DAME detection module has the ability to change and create new sensor groups which reflect the repositioning of sensors on the battlefield. Three groups can be created for Red and three for Blue. The program used by the controller is interactive and requires as input up to six different sensor types to include:

Ground moving target radar
Artillery counter-battery radar
Long range patrols
Remotely piloted vehicles
Side looking airborne radar platforms
Artillery observers

Program 11 of the DAME menu creates the sensor groups. These can be updated each game turn to reflect the changing status of the detection devices on the battlefield.

g. Combat Unit Patrols. The detection module also has the ability to create and send out recon elements from maneuver units. These units can be used to verify units that are in a "detected" status.

(1) The detection module is able to detect five generic types of systems within a given unit:

Personnel
Vehicles
Tanks/APCs
Artillery
Rockets

A threshold detection of certain numbers of these systems by a patrol will enable the patrol to identify a unit and change that unit's status to "acquired."

(2) The recon portion of the detection module can be used by any maneuver unit at a range of up to 12 kilometers.

(3) Maneuver units with organic infantry can send out multiple patrols, whereas non-infantry units can send out only one patrol.

6. GAME OPERATIONS - LOGISTICS.

a. General. The DAME Logistics module attempts to portray realistic supply consumption and resupply functions on the battlefield.

b. Structure.

(1) Logistics is represented in DAME by showing the battlefield relationship of the supply units to the maneuver units and by calculating the consumption and resupply of ammunition and fuel for each maneuver unit.

(2) As with movement, a map is used for the battlefield geometry. The location of supply dumps supporting Red regiments in the first echelon units and the primary lines of resupply are represented on the map. A stylized template showing resupply to Red battalions is applied to regimental positions when necessary to show resupply within the regiment. The completed map provides the gamers with the following information:

(a) Distance from supply points to supplied units.

(b) Primary target structure of the Red and Blue supply network showing gamers the locations of possible positions to attack.

(c) Choke points along principal supply routes which can be interdicted by air assets.

(3) The Blue resupply network for fuel and ammunition is also represented on the map. In this case the network is represented explicitly for Blue player units and notionally for Blue units at corps level and above. The network on the Red side of the FEBA will show notional supply lines to Blue maneuver battalion levels only. Requirements for company supply level are assumed to be accomplished by the parent battalion.

(4) The second part of the resource generating structure is in tabular form. Tables are used to calculate the ability of a supply unit to generate materiel for a supplied unit. Utilization of these tables will be discussed below.

c. Implementation.

(1) Unit resupply levels are initialized at the start of the game. After the completion of every game turn, the gamer assesses his current combat situation by studying the computerized unit status report (see Fig 2-3). In

this report the amount of fuel and ammunition consumed and on hand is displayed. This tells the gamer at a glance the logistical status of all his units. With this information they are then able to formulate and implement the appropriate resupply decisions.

(2) The computer, during the course of a game turn, will assess fuel and ammunition consumption based solely upon the mission performed during that CI. Thus gamers must be cognizant of the impact that mission status will have on consumption rates during the course of the game.

(3) Gamers should also be aware that the game controllers will assess appropriate degradation penalties against units that are low on supplies due to insufficient stocks of ammunition or POL.

d. The Resupply Function.

(1) Gamers initiate the resupply function of DAME by means of the combat support worksheet discussed in Chapter 2. Once a determination has been made to resupply a unit, the gamer must first determine the distance from the unit to be supplied to the supply point. This is simply measured as the appropriate road and/or cross country distance from supplied unit to supplying unit. The gamer must then determine whether the unit is to be resupplied with POL and/or ammunition. After making this determination, the gamer looks to see the number of cargo trucks available and accesses the appropriate resupply tables. (See Tables 6-1 to 6-8). In the case of Blue the table accessed will depend upon the type of unit to be supplied (artillery, armor or mech task force). The amount of fuel and ammunition that can be supplied to a given unit is a function of the distance involved and the number of supply vehicles. For example, an artillery battalion 40 kms from a resupply point with 10 tankers available for resupply purposes can supply 36,585 gallons of POL in a game turn. Ten ammunition resupply vehicles can supply 156 short tons of ammunition to an artillery unit.

(2) The gamer must now turn to that portion of the gamer worksheet (see fig 2-3) which deals with resupply (logistics and supply point columns). This worksheet, updated by the gamer, will be input into the computer by the controller.

(a) Logistics column of Gamer Worksheet.

1. "MISSION" indicates the new mission of the unit in question. Since consumption is based partially on mission profile, it is important that this is properly updated (simply cross out the old value and write in the current mission number).

# OF TRKS > / DIST v	1	2	3	4	5	6	7	8	9	10
10 km	25.4	50.8	76.2	101.6	127.0	152.4	177.8	203.2	228.6	154.0
20	21.0	42.0	63.0	84.0	105.0	126.0	147.0	168.0	189.0	210.0
30	17.9	35.8	58.7	71.6	89.5	107.4	125.3	143.2	161.1	179.0
40	15.6	31.2	46.8	62.4	78.0	93.6	109.2	124.8	140.4	156.0
50	13.9	27.8	41.7	55.6	69.5	83.4	97.3	111.2	125.1	139.0
60	12.4	24.8	37.2	49.6	62.0	74.4	86.8	99.2	111.6	124.0
70	11.3	22.6	33.9	45.2	56.5	67.8	79.1	90.4	101.7	113.9
80	10.3	20.6	30.9	41.2	51.5	61.8	72.1	82.4	92.7	103.0
90	9.5	19.0	28.5	38.0	47.5	57.0	66.5	76.0	85.5	95.0
100	8.8	17.6	26.4	35.2	44.0	52.8	61.6	70.4	99.2	88.0
120	7.7	15.4	23.1	30.8	38.5	46.2	53.9	61.6	69.3	77.0

Table 6-1. Blue Arty Bn AMMO Resupply.

SOURCE: Reference 63, 29.

# OF TRKS > / DIST V	1	2	3	4	5	6	7	8	9	10
10 km	5517	11194	16791	22388	27985	33582	39179	44776	50373	55970
20	4762	9524	14286	19048	23810	28371	38333	38095	42857	47619
30	4132	8264	12397	16529	20661	24793	28925	33058	37190	41322
40	3658	7317	10976	14634	18213	21951	25610	29268	32927	36585
50	3275	6650	9825	13100	16376	19651	22926	26201	29476	32751
60	2964	5929	8893	11858	14822	17786	20751	23715	26680	29644
70	2712	5425	8138	10850	13563	16275	18988	21700	24413	27125
80	2496	4992	7487	9983	12479	14975	17471	19966	22462	24958
90	2311	4622	6934	9245	11556	13867	16178	18490	20801	23112
100	2155	4310	6466	8621	10776	12931	15086	17242	19397	21362
120	1896	3793	5689	7585	9482	11378	13274	15170	17067	18963

Table 6-2. Blue Arty Bn POL Resupply.

# OF TRKS > / DIST V	1	2	3	4	5	6	7	8	9	10
10 km	4546	9091	13637	18182	22728	27273	31819	36364	40910	45455
20	3979	7958	11936	15915	19894	23873	27852	31830	35809	39788
30	3529	7059	10588	14118	17647	21176	24706	28235	31765	35294
40	3178	6356	9534	12712	15890	19068	22246	25124	28602	31780
50	2885	5769	8654	11538	14423	17308	20192	23077	25961	28846
60	2641	5282	7922	10563	13204	15845	18648	21126	23767	26408
70	2439	4878	7137	9756	12195	14634	17073	19512	21951	24390
80	2262	4525	6787	9050	11312	13574	15837	18099	20362	22624
90	2110	4219	6329	8439	10549	12658	14768	16878	18987	21097
100	1979	3958	5937	7916	9895	11873	13862	15831	17810	19789
120	1798	3517	5276	7034	8793	10551	12310	14068	15827	17585

Table 6-3. Blue POL Resupply (MECH BN TF).

# OF TRKS / DIST	1	2	3	4	5	6	7	8	9	10
10 km	5454	10909	16364	21818	27273	32727	38182	43636	49091	54545
20	4658	9317	13975	18634	23292	27950	32609	37267	41926	46584
30	4054	8108	12162	16216	20271	24325	28379	32433	36487	40541
40	3597	7194	10791	14388	17986	21583	25180	28777	32374	35971
50	3226	6452	9677	12903	16129	19355	22581	25806	29632	32258
60	2924	5848	8772	11696	14620	17544	20468	23392	26316	29240
70	2679	5357	8036	10714	13393	16072	18750	21429	24107	26786
80	2467	4934	7401	9868	12336	14803	17270	19737	22204	24671
90	2287	4573	6860	9146	11433	13720	16006	18293	20579	22866
100	2134	4267	6401	8535	10669	12802	14936	17070	19203	21337
120	1880	3759	5639	7519	9399	11278	13158	15038	16917	18797

Table 6-4. Blue POL Resupply (ARMOR BN TF).

# OF TRKS > / DIST v	1	2	3	4	5	6	7	8	9	10
10 km	8.9	17.8	26.7	35.6	44.5	53.4	62.3	71.2	80.1	89.0
20	7.7	15.4	23.1	30.8	38.5	46.2	53.9	61.6	69.3	77.0
30	6.9	13.8	20.7	27.6	34.5	41.4	48.3	55.2	62.1	69.0
40	6.2	12.4	18.6	24.8	31.0	37.2	43.4	49.6	55.8	62.0
50	5.6	11.2	16.8	22.4	28.0	33.6	39.2	44.8	50.4	56.0
60	5.1	10.2	15.3	20.4	25.5	30.6	35.7	40.8	45.9	51.0
70	4.7	9.4	14.1	18.8	23.5	28.2	32.9	37.6	42.3	47.0
80	4.4	8.8	13.2	17.6	22.0	26.4	30.8	35.2	39.6	44.0
90	4.1	8.2	12.3	16.4	20.5	24.6	28.7	32.8	36.9	41.0
100	3.8	7.6	11.4	15.2	19.0	22.8	26.6	30.4	34.2	38.0
120	3.4	6.8	10.2	13.6	17.0	20.4	23.8	27.2	30.6	34.0

Table 6-5. Blue AMMO Resupply (MECH BN TF).

DIST ∨ \ # OF TRKS >	1	2	3	4	5	6	7	8	9	10
10 km	13.1	26.2	39.3	52.4	65.5	78.6	91.7	104.8	117.9	131.0
20	11.5	23.0	34.5	46.0	57.5	69.0	80.5	92.0	103.5	115.0
30	10.1	20.2	30.3	40.4	50.5	60.6	70.7	80.8	90.9	101.0
40	9.1	18.1	27.3	36.4	45.5	54.6	63.7	72.8	81.9	91.0
50	8.3	16.6	24.9	33.2	41.5	49.8	58.1	66.4	74.7	83.0
60	7.6	15.2	22.8	30.4	38.0	45.6	53.2	60.8	68.4	76.0
70	7.0	14.0	21.0	28.0	35.0	42.0	49.0	56.0	63.0	70.0
80	6.5	13.0	19.5	26.0	32.5	39.0	45.5	52.0	58.5	65.0
90	6.0	12.0	18.0	24.0	30.0	36.0	42.0	48.0	54.0	60.0
100	5.7	11.4	17.1	22.8	28.5	34.2	39.9	45.6	51.3	57.0
120	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0

Table 6-6. Blue AMMO Resupply (ARMOR BN TF).

# OF TRKS > / DIST v	1	2	3	4	5	6	7	8	9	10
10 km	10.50	21.00	31.50	42.00	52.50	63.00	73.50	84.00	94.50	105.00
20	8.88	17.76	26.64	35.52	44.40	53.28	62.16	71.04	79.92	88.80
30	7.86	15.72	23.58	31.44	39.30	47.16	55.02	62.88	70.74	78.60
40	6.99	13.98	20.97	27.96	34.95	41.94	48.93	55.92	69.91	69.90
50	6.30	12.60	18.90	25.20	31.50	37.80	44.10	50.40	56.70	63.00
60	5.70	11.40	17.10	22.80	28.50	34.20	39.90	45.60	51.30	57.00
70	5.25	10.50	15.75	21.00	76.25	31.50	36.75	42.00	47.25	52.50
80	4.84	9.69	14.54	19.38	24.22	29.07	33.92	38.76	43.60	48.45
90	4.98	8.97	13.46	17.94	22.42	26.91	31.40	35.88	40.36	44.85
100	4.185	8.37	12.56	16.74	20.92	25.11	29.30	33.48	37.66	41.85
110	3.75	7.50	11.25	15.00	18.75	22.50	26.25	30.00	33.75	37.50
120	3.69	7.38	11.07	14.76	18.45	22.14	25.83	29.52	33.21	36.90

Table 6-7. Red AMMO Resupply.

# OF TRKS > / DIST V	1	2	3	4	5	6	7	8	9	10
10 km	3280	6561	9841	13122	16402	19682	22963	26243	29524	32804
20	2842	5683	8525	11367	14208	17050	19892	22733	25575	28416
30	2564	5128	7693	10256	12821	15385	18949	20513	23078	25642
40	2205	4409	6614	8818	11023	13228	15432	17637	19891	22046
50	1986	3972	5958	7944	9930	11916	13902	15888	17874	19860
60	1087	3615	5422	7229	9036	10844	12651	14458	16266	18073
70	1661	3322	4983	6645	8306	9967	11628	13289	14950	16612
80	1535	3069	4604	6138	7673	9207	10742	12277	13811	15346
90	1426	2852	4278	5704	7130	8556	9982	11408	12834	14260
100	1334	2668	4021	5335	6669	8003	9336	10670	12004	13172
110	1236	1473	3709	4945	6182	7418	8654	9890	11127	1236
120	1180	2359	3539	4718	5898	7077	8257	9436	10616	11795

Table 6-8. Red POL Resupply.

2. "RESUPPLY-AMMO" indicates the amount of ammunition (in short tons) that he wishes to resupply that unit. Insure that this number is consistent with the number of supply vehicles available and the supply distance involved and recall that this value is then derived from the appropriate resupply table.

3. "RESUPPLY-POL" indicates the amount of POL to be resupplied to that unit.

4. "DIST KM" indicates the distance that unit will travel during the current CI (see para 7, MOVEMENT).

(b) Supply Point Column.

1. "FRACTION POL TK" refers to the fraction of cargo trucks (item 9 in equipment list) which are fuel tankers. This fraction changes only if fuel or ammo trucks are added or replaced in the unit during the game. The fraction must then be re-calculated.

2. "POL" indicates the amount of POL that a unit has distributed to another unit. This entry will generally be updated when the unit in question is a supply point. For example, a FARP distributes 1,000 gallons of POL. The gamer will simply write "1,000" in the "SUPPLY PT POL" column for the appropriate unit.

3. "AMMO" indicates amount of ammo distributed by the unit to other units. Note that it is important in every case to "zero-out" all changes made to the worksheet from the previous turns, otherwise these will be input as valid parameters for the next turn. For example, a unit that had received 50 tons of ammunition in the previous turn will continue to receive 50 tons of ammunition on each subsequent turn unless this value is changed to zero.

(3) The gamer should also carefully note the amount of supply he has available for that turn as indicated on the unit status report. Supply assets incur casualties just as combat systems do.

7. GAME OPERATIONS - MOVEMENT.

a. General.

(1) The section on movement provides the gamer with a set of consistent rules with which to maneuver his combat and support units. These rules apply to movement prior to actual combat.

(2) Advance rates during combat are determined by the controller. The controller(s) must decide whether a force is able to advance based on considerations of maneuver, firepower, and combat service support. Generally, an attacking unit may advance against an opposing unit when it has a combat advantage of 2:1. Other considerations that impact on advance rates include the following factors:

(a) In addition to casualties and damage, artillery fires affect rates of advance as follows:

1. Artillery fire on an attacking non-mechanized infantry unit halts that unit in place for 30 minutes.

2. Artillery fire on a defending unit permits the attacking force to advance at an accelerated rate depending on the type of attacking unit.

3. Artillery fire on mechanized units causes casualties only to exposed personnel.

(b) Effects of nuclear fires will be determined by target analysis using Table 7-9. This table generates tree blowdown and rubbled areas which preclude maneuver.

(c) Degradation to command and control may slow unit advances.

(d) Failure to conduct combat service support actions, such as POL resupply, will affect advance rates as determined by the controller.

(e) Advance rates will be affected by obstacles as well as nuclear and chemical contamination of terrain.

(f) Air interdiction will affect advance rates as determined by the controller.

b. <u>Ground Movement Rates</u>.

(1) Sustained movement rates prior to combat are summarized in Table 7-1.

(2) Movement rates are degraded when the force is being interdicted by air or artillery fire. Reductions of up to 75 percent may be assessed based on the type and quantity of combat, etc.

(3) After an attack against a defended position the attacking unit is delayed from further movement for a period of 3 hours.

(4) Blue and Red chemical contamination uses a simple area calculation. Using a simple template, the affected contamination areas are indicated on the playing map. Template areas are indicated in Table 7-2. The width of the affected area is at right angles to the firing line. Air temperature is assumed to be 50^{o}F.

Table 7-1. Movement Rates

	DAY		NIGHT	
	TRACK/TRUCK	PERSONNEL	TRACK/TRUCK	PERSONNEL
Primary Road	20 KPH	3 KPH	10 KPH	3.5 KPH
Secondary Road	10 KPH	2.5 KPH	5 KPH	3 KPH
Trails	6 KPH	2.5 KPH	3 KPH	3 KPH
Cross Country:				
Mixed	10 KPH	2 KPH	8 KPH	3 KPH
Mountains	RESTRICTED TO ROADS		RESTRICTED TO ROADS	

Notes: Weather factors will degrade the above rates accordingly:

Snow: .50 of existing rate

Rain: .75 of existing rate

Movement through chemical and nuclear contamination will affect movement as follows:

Chemical: .95 of existing rate

Nuclear: .9 of existing rate

SOURCE: Reference 30.

Table 7-2. Contaminated Areas Generated by Chemical Munitions

	Affected Area		
Force	Blue Persistent	Red Persistent	Duration (days)
Battery	320m x 730m	180m x 320m	10
Battalion	800m x 730m	380m x 320m	35

SOURCE: Reference 63.

c. Air Movement Rates.

(1) Generally, air movement applies to the Blue forces using the UH-60A. The following rules apply:

(a) Sustained speed is 150 KPH. This figure includes factors for refueling and maintenance delays.

(b) Aircraft operational readiness (OR) rate is .81 of aircraft available.

(c) The following relationship determines the time to move troops from an origin point to a destination; troops are considered to move with personal gear, individual weapons and assigned AT weapons. Vehicles are not flown by UH-60A:

Time = ID/150 + (INF * RT)/(HTC * HA * .81 * 150)

where ID = initial distance from CSAB to pick-up point
INF = number of infantry to be lifted
RT = round trip distance from origin to destination
HTC = helicopter troop capacity
HA = helicopters available
150 = sustained speed of UH-60A (in KPH)
.81 = UH-60A availability rate

The arrival rate of troops may be assumed to be a fraction based on time required to move the entire force.

(d) Helicopters will be attrited by controller judgment subject to mission use, ADA exposure, etc. The total of lift helicopters available will be posted on the CSAB map symbol each CI.

(e) Blue forces may dismount TOW and move it by helicopter by allocating one-half helicopter sortie per TOW moved.

(2) Red air movement will utilize HIP, HOOK, and HALO helicopters for troop and equipment lift. The equation above will be used to generate travel time using the following factors.

(a) Payload (troop capacity) of the following helicopters is HIP (28), HOOK (55), and HALO A (80).

(b) Sustained speed for Red helicopters is 120 KPH.

(c) Helicopters will be considered to have their normal operating range. However, due to tactical considerations, Red airmobile operations will be limited to a maximum of 50 km forward of Red ground units.

(d) Red helicopters have an OR rate of .76 of available helicopters.

(e) Helicopters will be attrited by gamer judgment subject to mission use, ADA exposure, etc. A running total of Red troop lift helicopters will be posted on the unit symbol.

d. Countermobility.

(1) General. Countermobility measures are used to impede the enemy's ability to move and maneuver. These measures generally involve the modification of the terrain within the battlefield environment and include the use of minefields, the creation of physical obstacles, and delays caused primarily by the effects of nuclear explosions.

(2) Minefields. There are several types of minefields as well as several methods and procedures for breaching and laying them.

(a) Table 7-3 provides gamer rules for mine emplacement.

(b) Table 7-4 indicates minefield breaching times and requirements.

(3) Obstacles. Obstacles are employed to canalize, direct, restrict or stop the movement of an opposing force. However, obstacles affect friendly as well as enemy troops, and controllers will impose appropriate delays in all cases.

(a) Table 7-5 is used for gaming estimates of types of material and manpower requirements for artificial obstacles.

(b) Table 7-6 lists the material and labor requirements for constructing 300-meter sections of various types of barbed wire obstacles. This table and the following rules of thumb may be used to estimate the material, manpower, and transportation requirements for barbed wire obstacles.

1. Length of tactical wire entanglements is 1 1/2 times the length of front times the number of belts.

2. Length of protective wire entanglements is 5 times the length of front times the number of belts. Protective wire for units is 2 1/2 times the average platoon frontage times the number of platoons involved.

3. Length of supplementary wire at the FLOT is 1 1/4 times the length of front times the number of belts. Length of supplementary wire behind the FLOT is 2 1/2 times the distance from the FLOT to the rearmost reserve unit times the number of belts.

Table 7-3. MANPOWER, MATERIAL, AND TRANSPORTATION REQUIREMENTS FOR MINEFIELD OPERATIONS

Density			Strips rqr	Mines Required			Crated Mines		Vehicles required for crated mines		Man-hours	Meters of wire	Number of pickets
AT	Apers frag	Apers blast		AT	Apers frag	Apers blast	Weight in tons	Volume in cu ft	5T cargo (wt governs)	5T dump (vol governs)			
1	1	1	3	164	164	164	4.98	228.5	1.00	1.68	87	1200	30
1	2	2	3	164	312	312	5.85	260.1	1.17	1.91	120	1200	30
1	4	8	8	164	623	1213	7.82	337.8	1.57	2.47	234	2000	50
2	4	8	9	312	623	1213	11.44	512.7	2.29	3.76	279	2400	60
3	4	8	9	459	623	1213	15.05	686.7	3.01	5.03	323	2400	60

Explanatory notes:

1. AT, Apers Frag and Apers Blast mines are M15, M16, and M14, respectively.
2. Mine totals include IOE and 10% safety factor.
3. IOE cluster composition used is 1-2-2 (except for the 1-1-1 and 1-2-2 minefields where the IOE cluster composition is 1-1-1).
4. Man-hours are based on laying rate of 4 AT, or 8 AP fragmentation, or 16 AP blast mines per man-hour. Includes 20% factor to compensate for minefield siting, marking, and recording.
5. Quantities indicated are for 100 meter of front.
6. IOE = Irregular Outer Edge.

"STANDARD OBSTACLE" APPENDIX
FROM EUROPE III CORPS OPLAN ENGR/OBS ANNEX

Table
7-4. MINEFIELD AVERAGE BREACHING/CLEARING TIME AND MATERIAL REQUIREMENTS

Method	Width of cleared lane (in meters)	Man-hours rqr per 100 meters	Remarks
<u>Manual</u>			
Location by probing	1 (footpath)	16-22	See note.
Removal by rope or explosives	8 (one-way vehicle lane)	38-44	See note.
Location by detector, assisted by probing	8 (one-way vehicle lane)	27-33	See note.
Removal by rope or explosives	8	220-247	See note.
<u>Explosive</u>			
Demolition snakes, M3A1	6	40-100	
Demolition snake M157 (Diamond Lil)	3.5--4.5	6-8	+6--8 manhours to assemble
Bangalore torpedo	1 (footpath)	3.5--4.5	See note.
Rocket propelled line charge, M58A1	8		40M standoff
<u>Roller</u>	1 vehicle		Speed = 8 kph

NOTE: Based upon average conditions of visibility and moderate enemy activity and normal US countermeasures; i.e., screening of enemy observation and counterbattery fires against hostile artillery or other weapons covering the field.

SOURCE: Reference 62.

1	2	3	4	5	6	7	8	9	10	11	12	13
	Defensive Operations				Retrograde Operations				Offensive Operations			
Item and Unit	Easy movement	Moderate movement	Difficult movement	Very diff. movement	Easy movement	Moderate movement	Difficult movement	Very diff. movement	Easy movement	Moderate movement	Difficult movement	Very diff. movement
Obstacles												
2 Hwy bridges (each)	40.0	35.0	30.0	15.0	35.0	30.0	20.0	15.0	4.0	4.0	3.0	2.0
3 RR bridges (each)	3.0	3.0	3.0	2.0	3.0	3.0	3.0	2.0				
4 Tunnels (each)				1.0				1.0				
5 Abatis (each)	7.0	15.0	25.0	30.0	6.0	8.0	12.0	14.0	1.0	1.0	1.0	1.0
6 Road craters (each)	75.0	68.0	68.0	66.0	28.0	28.0	30.0	36.0	1.0	1.0	1.0	2.0
Barbed-wire entanglements												
7 Double apron 4 2 pace (km)	25.0	25.0	25.0	25.0	2.5	2.5	2.5	2.5				
8 4-strand protective (km)	20.0	10.0	10.0	1.0	1.0	1.0	1.0	1.0				
9 Triple concertina (km)	6.5	6.5	6.5	6.5	0.5	0.5	0.5	0.5				
Material												
10 Antitank mines (each)	58,117.0	44,478.0	29.853.0	15,678.0	10,577.0	8,841.0	6,075.0	4,012.0	2,030.0	1,360.0	842.0	742.0
11 Antipersonnel mines:												
Frag. (ea)	118,132.0	93,914.0	63,469.0	34,996.0	59,647.0	51,013.0	36,567.0	25,253.0	4,017.0	2,679.0	1,900.0	1,700.0
12 Blast (ea)	198,270.0	153,820.0	100,874.0	52,538.0	42,911.0	37.024.0	23,987.0	17,078.0	6,741.0	4,228.0	2,892.0	2,692.0
13 Firing devices assorted (ea)	16,761.0	12,844.0	8,722.0	4,569.0	3,396.0	2,837.0	2,007.0	1,315.0	499.0	337.0	187.0	187.0
14 Trip flares	3,655.0	3,275.0	2,855.0	2,475.0	400.0	358.0	300.0	258.0	100.0	70.0	30.0	30.0
15 Explosives (total)(lb)	99,000.0	93,800.0	93,980.0	88,600.0	65,300.0	60,300.0	54,500.0	52,600.0	5,100.0	5,100.0	4,100.0	3,100.0
16 Barbed wire (400 yd reels)	1,214.6	1,172.9	1,126.8	1,084.0	120.0	110.0	110.0	108.7	5.6	3.4	2.3	2.3
17 Concertina coils (ea)	1,281.0	1,281.0	1,281.0	1,281.0	98.6	98.6	98.6	98.6				
18 Short tons	2,291.2	1,820.4	1,324.8	826.0	655.3	559.7	415.6	301.4	72.5	49.7	32.9	30.0
19 Measurement tons	2,473.7	1,948.0	1,383.2	827.8	610.1	519.3	372.3	265.5	79.6	53.6	3.7	30.8
Manpower												
20 Platoon-hours (30 men)	1,981.0	1,600.0	1,174.0	753.5	596.6	512.6	382.6	281.9	63.0	43.0	29.8	27.2
21 Battalion-days (10-hr day, 4 co, 3 plt ea)	16.5	13.3	9.8	6.3	5.0	4.3	3.6	2.3	0.5	0.4	0.3	0.2

See notes on following page.

Table 7-5. Average Requirements for Artificial Obstacles (400 Square Kilometers).

NOTES:

1. Terrain types having following characteristics:

   a. Movement.

      (1) Easy. Rolling or level, mostly open, trafficable land. (No one obstacle or combination of obstacles comprises more than 25% of the area.)

      (2) Moderate. Low hills, scattered forest, poorly drained land. (Any one type of obstacle or combination of obstacles comprises 25 to 50% of the area.)

      (3) Difficult. High hills, broken forests, poorly drained land. (Any one type of obstacle or combination of obstacles comprises 50 to 75% of the area.)

      (4) Very difficult. Mountains, forests, marshes. (Any one type of obstacle or combination of obstacles comprises 75% of the area.)

      (5) The more trafficable the terrain, the more obstacles required.

   b. Obstacles.

      (1) Hills and mountains--steep slopes and rough terrain.

      (2) Forests--dense woods with trees that are large enough to stop tanks.

      (3) Marsh--wet, swampy, untrafficable ground.

2. Does not include tactical wire.

3. Items 2-6. Indicates numbers of obstacles to be emplaced as a function of terrain. For example, in "easy movement" type terrain 75 road craters are required to impede enemy movement in 400 square kilometers during a defensive operation.

4. Items 7-9. Indicates length of required barbed-wire entanglements as a function of terrain.

5. Items 10-19. Indicates material requirements as a function of terrain.

6. Items 20-21. Indicates manpower requirements as a function of terrain.

SOURCE: Reference 62.

Table 7-6. Material Requirements for Construction of 300 Meters of Expedient Concertina Wire Entanglements

1		2	3
		Kilograms of materials per 300 m of entanglement[a]	Man-hours to errect entanglement[b]
1	Type of entanglement	Std concertina/barbed tape	
2	Double-apron, 4- & 2-pace	1380/1050	59
3	Double-apron, 6- & 3-pace	1080/780	49
4	High wire (less guy wires)	1590/1200	79
5	Low wire, 4- & 2-pace	1080/840	49
6	4-strand fence	660/540	20
7	Double expedient concertina	2070/	40[c]
8	Triple expedient concertina	3120/	99[c]
9	Triple standard concertina	2370/1620	30[c]

[a]Average weight when any issue metal pickets are used.

[b]Man-hours are based on the use of screw pickets. With the exception of the triple-standard concertinas, add 20 percent to the man-hours when driven pickets are used. With experienced troops, reduce man-hours by one-third. Increase man-hours by 50 percent for nightwork.

[c]Based on concertinas being made up in rear areas and ready for issue. One expedient concertina opens to 6-meter length, as compared with 15 meters for a standard concertina for ties.

SOURCE: Reference 62.

(c) Table 7-7 details obstacle construction data.

(d) Table 7-8 may be used for initial estimates of materiel and manpower requirements for the more common types of demolition tasks required in creating and removing obstacles.

(4) Crater Delays. The net effect of delays due to craters is similar to those caused by minefields and obstacles. However, these delays are of a more random nature, occurring intermittently throughout the battlefield as a result of the terminal effects of various munitions. It is expected that delays on the integrated battlefield will be of a more catastrophic nature.

(a) The following outlines the effects of delays due to enemy air action.

Bomb weight	Delay (after) arrival of men and material	Requirements for repair
100 lb	None	None
300 to 600 lb	2 hr	1 engineer plat; 3 trailer loads timber or equivalent
1,000 to 2,000 lb	4 hr	1 engineer plat; 6 trailer loads timber or equivalent

(b) Delay and repair requirements for steel truss and concrete bridges of substantial construction are as follows:

1. For railroad and wooden highway bridges a 100-pound or heavier bomb causes the same delay and requirements for repair shown for 300 to 600 pound bombs in the above figure.

2. For pontoon bridges, a 100 pound or heavier bomb requires a 1 hour delay after material for 1/3 (or four spaces) of the bridge is placed at the site.

3. The above effects are for one hit; for more than one hit, delay and requirements for repair are increased accordingly.

(b) Table 7-9 outlines the damage reduction rules for the effects of nuclear blast. As a general rule of thumb the rate of clearance of tree blowdown resulting from a nuclear burst is 250 meters per engineer bulldozer and associated equipment per hour.

Table 7-7. OBSTACLE CONSTRUCTION DATA

Antitank ditch	By multiple-charge method-- 10 ft deep 30 ft wide	(1) For permanent system of fortifications: Construct across wide avenues of approach. (2) For hasty or temporary fortifications. Construct across only short distances--25 to 50 ft.	One squad with power earth auger and demolition equipment can complete 100 yds in 12 hr.
	By hand tools-- 6 ft deep 12 ft wide		One platoon under average conditions can do 100 ft of triangular ditch in 7 1/2 hr, and 100 ft of trapezoidal ditch in 14 hr. See STANDARD OBSTACLES
Log post obstacle	Substantial posts set in the ground, density of 1 post per lineal foot, 2 1/2 to 3 1/2 ft projection.		One squad with piledriver can complete 50 ft in 1 day under average conditions.
Contamination by persistent chemicals (when authorized).	Contaminate artificial obstacles to impede removal. Contaminate roads and areas as part of a barrier . mission.	One or more chemical mines per obstacle. 200 mines per mile of road, or-- Airplane spray: Average area covered by 1 airplane-- 80 yd long 200 yd wide	One squad can contaminate 1 mile of road in 1 1/2 hr.

(d) The next table may be used for initial estimates of materiel and manpower requirements for the more common types of demolition tasks required in creating and removing obstacles.

SOURCE: Reference 1.

Table 7-8. MATERIEL AND MANPOWER REQUIREMENTS FOR DEMOLITION OF INDIVIDUAL BARRIER TARGETS

	1	2	3	4	5	6	7
	Target	C-4 (lb)	TNT (lb)	Cratering charge (40-lb)	Shaped charge (40-lb)	Thermite grenades (each)	Squad-hours (10 men)
	Highways						
2	Major bridge (more than 400 ft)	[illegible]00		20			3.0
3	Minor bridge (up to 400 ft)	400		15			2.0
4	Tunnel		12,000				5.0
5	Road crater (deliberate 25 ft road)		500	10	6-15		1.25
	Railroads						
	Major bridge (more than 400 ft):						
6	Single track		3,000				6.0
7	Double track		4,500				6.0
	Minor bridge (up to 400 ft)						
8	Single track		2,000				4.0
9	Double track		3,000				4.0
10	Tunnel		12,000				5.0
11	Terminal facilities	542	[illegible]			43	3.2
12	Rolling stock (locomotive and 30 cars)	6				121	3.2
	Airfields						
13	Runaway (per 1,000 ft)		5,500		25		8.0
	Fuel storage (per tk):						
14	Below ground		400			1	1.0
15	Above ground				1	1	0.2
16	Radar/radio apparatus		30			10	0.4
	POL facilities						
17	Storage and handling	4		15		10	1.2
18	Refining facilities	80				15	0.8
19	Distribution	10				2	0.2
	Electric power denial						
20	Generator		150			10	1.0
21	Transformer station		100			25	1.0
	Telecommunication denial						
22	Telegraph exchange	10				1	0.1
23	Telephone exchange	20				2	0.2
24	Repeater/radio station	40				2	0.2
25	Radio station	40					0.2
26	Radio link terminal	40					0.2
	Waterway denial						
27	Lock	110					0.6
28	Weir		1,000				2.0
29	Levee wall, aqueduct, or siphon			15			2.0
30	Dam (navigation	500					2.5
31	Inland port facilities	20	20				0.4

NOTE: Where data in columns in 2-6 inclusive appear in more than one column for a given target all of the materiel shown are required for demolition of that target.

SOURCE: Reference 62.

Table 7-9. Tree Blowdown Clearance Capability

Equipment[1]	Time required per piece of clearing equipment (hours)[2]	Capability
Crawler tractor D7 or TD 18	14	Clearing a path 6 meters wide per kilometer through previously uncleared forest, type II, III, and IVA trees presenting moderate to severe obstacles.
Crawler tractor D8 or TD 24	11	
Combat engineer vehicle (not buttoned up)	16	
Combat engineer vehicle (buttoned up)	27	

[1]In the field, availability of specific equipment applies.
[2]With clearing crews and helicopters available, as needed.

Time for Rubble Clearance for Passage of Vehicles

Clearance for	Time for clearance equipment used (hours)[1]: Crawler tractor D7 or TD18	Crawler tractor D8 or TD24	Combat engineer vehicle (not buttoned up)	Combat Engineer vehicle (buttoned up)
Wheeled vehicles	15	15	16	18
Tracked vehicles	1 1/2	1 1/2	1 1/2	2

[1]For clearing a path 6 meters wide through 1 kilometer of rubble.

Nuclear Crater Reduction

Yield, KT surface burst, saturated soil on low ground (water slowly fills crater) KT	Passage for tracked vehicles (days) using one engineer combat company Days	Passage for wheeled vehicles (days) using one engineer combat company Days
2	2	5
10	3	16
20	7	24
100	10	32
200	15	48

SOURCE: Reference 62.

8. METHODOLOGY FOR COMPUTER ASSESSMENTS.

a. General. This section provides the methodology for the computer routines in DAME. This section is primarily directed toward the computer programmer/analyst, as opposed to the gamer, and provides a detailed verbal description of the various sub-modules found in DAME. A code listing, variable listing, and data structure for each sub-module can be found in Appendix B.

b. Attrition Module. The ground attrition module is Program 1 on the DAME menu. This program assesses losses to Red and Blue units from direct fire, indirect fire, attack helicopters, Copperhead, and minefields. The assessment methodology has been derived from the CACDA Jiffy III Wargame. This methodology has been simplified to produce more generalized assessments. Further information on JIFFY methodology can be found in reference 52.

(1) Grouping of forces. As previously discussed, the gamers are required to group forces into sectors for attrition assessments. The attrition module is then used to assess losses to these groups of forces based on their composition, lethality, vulnerability, and the combat descriptors determined by the gamers. Combat in DAME can be visualized as one "blob" of forces pitted against another in combat, with a rudimentary battlefield geometry and firing logic determining firing priorities, target exposure, and other attrition factors.

(2) Rate of advance and suppression calculations. DAME calculates a rate of advance which is expressed as the distance covered in a specific period of time. The rate of advance used in DAME is based on firepower scores. Firepower scores are simply numerical values assigned to weapons systems which quantify their potential to inflict damage. The firepower score used is a sum of the scores of direct and indirect fire systems involved in the sector battle. The data base used was derived from historical rate of movement data employed in JIFFY. These rates are based on an adjusted firepower score and consider the effects of the tactical situation, smoke, terrain, and visibility. The attacker-to-defender firepower calculation expressed algebraically is:

$$FPR = \frac{\sum_i AF * N_i * FPS_i * SM_i}{\sum_k DF * N_k * FPS_k * SM_k}$$

where:

FPR = firepower ratio
N = number of kth defending and ith attacking systems
FPS = firepower of ith and kth systems
DF = defender situation factor
AF = attacker situation factor
SM = fraction of ith and kth systems not smoked

The firepower ratio yields a value which is used to access a data base to provide a movement value. This value may be modified by gamer judgment depending on the game situation. The direct fire firepower score is also used to generate a suppression factor for use in the direct fire assessments.

(3) Suppression. Suppression is played in DAME as a decrement to the number of weapon systems available to fire. Suppression is based on firepower ratios as a measurement of the volume of fire and is adjusted for the vulnerability of each particular weapon system. The weapon systems of the maneuver and fire support elements of the opposing forces are considered. The firepower ratio used for the suppression factor of maneuver weapon systems of the fire support elements are generally considered to be beyond the direct fire range of the maneuver element weapon systems. Therefore, the firepower ratio used to determine the fire support suppression factor is the fire support firepower ratio. As defined above, the fire support firepower ratio is determined by the number of air defense artillery and missiles, mortars, fielc artillery and rockets, and tactical aircraft. Values for the suppression factor are derived from RAC's Theater Battle Model-68, and are identical to those used in Jiffy.

(4) Generalized assessment. Except for minefield and chemical losses combat is determined in a nonlinear fashion. The generalized form of the equation is:

$$K_k = \left[1 - \prod_{\text{all } i} \left(1 - \frac{SSKP_{ik}}{T_k} \right)^{R_{ik}} \right] * T_k$$

where, for i on k engagements:

K_k = the number of targets killed by all firers
T_k = the number of targets engaged
R_{ik} = the number of rounds fired by weapons i at target k
$SSKP_{ik}$ = single shot kill probability of weapons i on target k

This equation assumes:

(a) Each target has probability of $1/T_k$ that it will be selected to be shot at for each round fired.

(b) The rounds are uniformly distributed against all appropriate targets.

(c) Each firing is an independent event; a target may be engaged more than once, even after being damaged or killed.

(5) Indirect fire assessment. The indirect fire assessment determines the materiel and personnel losses from artillery and mortar systems

and losses to vehicles from Copperhead. The assessment methodology is one-sided and is repeated for all indirect fire weapon-target combinations. The methodology addresses each force, in turn, and computes the expected number of casualties a force's indirect fire assets can inflict on the opposition as determined by the number of each specific area target contained in the enemy force, the number of battery missions available for firing at each specific area target, and the combination of these parameters in the nonlinear assessment equation. The computed losses are not subtracted from the force until all assessments in a phase of indirect fire combat have been made, so the order of assessing the forces does not affect the outcome.

(a) Assumptions.

1. Battery missions are generated from the Red/Blue Indirect Fire Worksheets, which aggregate all artillery types available into a single equivalent.

2. The number of effective missions fired in a sector battle is a gamer determination based on firing position, rate, and ammunition and weapon availability.

3. Area targets are homogeneous and generally company size.

4. Both the Blue and Red forces have the capability to fire improved conventional munitions-dual purpose (ICM-DP).

5. Crew casualties are assessed in proportion to the number of crew served weapons and vehicles lost.

6. Mounted infantry casualties are assessed in proportion to personnel carrier losses.

7. Infantry matériel losses are assessed in proportion to infantry personnel casualties.

8. A CLGP mission consists of two rounds fired at an interval of 20 seconds. Two CLGP missions may be fired for each 8 tube - 155mm howitzer battery mission available, but every CLGP mission reduces the battery missions for conventional fire by 1/4 of a mission, and the 8 tube - 155mm howitzer battery mission will be reduced by 1/3 of the mission. CLGP rounds are fired at direct fire systems.

(b) Area targets. The indirect fire weapon systems fire at targets that are composed of homogeneous elements (weapon systems). The targets are typically company size, meaning the number of elements in a given target represents the expected number found in a company size area. The number of the kth type area targets (AT_k) in a force is determined by the following equation:

$$AT_k = N_k \cdot Q_k/E_k$$

where for the kth type weapon systems:

AT_k = the number of area targets in the force.
Q_k = the probability that the area target will be acquired and targeted.
N_k = the number of elements in the force.
E_k = the number of elements in an area target.

(c) Fire distribution. The number of battery missions fired at each specified type of target depends on the distribution of the indirect fire battery missions available to be fired. The fire distribution is determined by an algorithm that considers a targeting scheme and the LEGAL MIX V concept of military worth of the target. In general, indirect fire battery missions are distributed among all appropriate targets according to the expression:

$$FDF_k = \frac{AT_k \cdot MW_k \cdot FAC_k}{\sum_{\text{all } k} (AT_k \cdot MW_k \cdot FAC_k)}$$

where for the kth type of area target:

FDF_k = the fire distribution factor.
AT_k = the number of area targets.
MW_k = military worth (target value) of target cluster.
FAC_k = fire allocation constant which filters out inappropriate targets, such as direct support fires targeted at artillery targets.

(d) Available battery missions. The battery missions available are manually computed, as explained in the attrition rules section. Battery missions are either direct support or counterbattery missions as determined by the gamer. The distribution of battery missions is given by:

$$BM_k = MA \cdot FDF_k \cdot DSF$$

where for k type area targets

BM_k = number of battery missions fired
MA = total number of missions available
DSF = fraction of missions in direct support. Becomes (1-DSF) for counterbattery assessments.

(e) Fractional damage. Indirect fire weapon system effectiveness is based on a measurement known as fractional damage. Fractional damage is that portion of a target complex that is expected to be damaged for each indirect fire battery mission fired at the target. Since Cannon Launched Guided Projectiles (CLGP) rounds are fired at point targets, and not area targets, fractional damage is not a meaningful measure of effectiveness for them. CLGP assessments are discussed in subparagraph (g) below.

(f) Indirect fire assessment algorithm. The form of the generalized assessment formula that calculates the expected number of personnel casualties and materiel losses as a result of the indirect fire combat is:

$$IDFK_k = \left\{ 1 - \left[1 - \left(\frac{FD_k}{AT_k} \right) \right]^{BM_k} \right\} * AT_k * E_k$$

where for the ith type firers shooting at the kth type area targets:

$IDFK_k$ = the number of target elements killed by all indirect fire weapons.
FD_k = the expected fractional damage to the area target for each indirect fire mission it receives.
AT_k = the number of area targets.
BM_k = the number of battery missions fired at the area targets.
E_k = the number of elements in an area target.

(g) CLGP. Cannon Launched Guided Projectiles (CLGP) are played in the game as Blue indirect fire weapon systems that fire at point targets. CLGP missions are fired by 155mm howitzers, towed or self-propelled. A CLGP mission is considered to consist of two 155mm tubes firing one round each, 20 seconds apart. Guidance for the CLGP rounds is assumed to be provided by a ground locator laser designator (GLLD). The number of CLGP missions available to be fired is equal to twice the number of 155mm 8-tube battery missions available. Since a CLGP mission requires two tubes to fire, the number of available 155mm missions for an 8-tube battery is reduced by 1/4 of a mission for every CLGP mission fired.

1. The CLGP missions are fired at Red armor vehicles, which include tanks, BMPs, BRDMs, BTRs, and mounted air defense weapons. Smoke does not degrade the allocation of artillery targets to CLGP. Because the CLGP missions are fired at these point targets, their fire distribution algorithm differs from that of the other indirect fire missions. The CLGP fire distribution is expressed as:

$$FDF_k = \frac{N_k \cdot OA_k \cdot SM_k \cdot MW_k}{\sum_{\text{all } k} N_k \cdot OA_k \cdot SM_k \cdot MW_k}$$

where for the kth type target:

FDF_k = the fraction of the CLGP missions to be fired against the kth type weapon systems.
N_k = the number of kth type weapon systems.
OA_k = operational availability.
SM_k = the percent of unsmoked targets (SM_k = 1 for artillery targets).
MW_k = target value of target k.

From this expression it may be observed that the number of CLGP missions fired at each type of weapon system target is proportional to the weighted value of those weapon systems engaged in combat.

2. The assessment equation for CLGP missions was derived from the same general form as was the indirect fire assessment equation. The CLGP assessment equation is expressed as:

$$CLGPK_k = \left[1 - \left(1 - \frac{PK_k * LDS}{N_k * OA_k * PSN_k * SM_k}\right)^{R_k}\right] * N_k * OA_k * PSN * SM_k$$

where, for each CLGP round fired at the kth type weapons, with N_k and OA_k as defined above:

$CLGPK_k$ = the number of kth type weapons killed.
PK_k = the probability of killing a kth type weapon for each CLGP round fired.
LDS = the probability the ground locator laser designator (GLLD) is not suppressed or the survivability of the aerial designator.
PSN = percent of force deployed forward.
SM_k = the percent of unsmoked targets.
R_k = the number of CLGP rounds fired at the kth type weapons and is expressed by:

$$R_k = 2 \cdot M \cdot PAQ \cdot PD \cdot TD$$

where:

M = number of missions fired.
PAQ = an atmospheric degradation factor.
TD = a terrain degradation factor.
PD = a degradation factor accounting for suppression of the designator.

(h) Other assessments due to indirect fire combat. Since the indirect fire combat assesses dismounted infantry and crew-served weapons losses only from indirect fire, additional attrition of crews, mounted infantry personnel, and the materiel losses associated with infantry casualties are made in accordance with the methods presented under infantry assessments.

(6) Minefield attrition.

(a) General. The minefield assessments determine the attrition of dismounted infantry personnel and armored vehicles as a result of an attacking force passing through a mined sector using "bull" tactics or a hasty breach technique. The methodology considers both conventional and FASCAM minefields against attacker weapon systems; defenders are not assessed. The expected losses are determined linearly based on mine density and the minefield-sector geometry. The data for conventional minefields are extracted from the Army field manuals on maneuver control (FM 105-5 and FM 90-7) and landmine warfare (FM 20-32). The mine effectiveness data consider antitank (M15), antipersonnel blast (M14), and antipersonnel fragmentation (M16) type mines.

(b) Assumptions.

1. Attacking weapons systems are considered to be dispersed uniformly across the trafficable terrain of the sector.

2. The Red force is using a hasty breach technique to pass through the minefield. If the Red force is bypassing, clearing, or deliberately breaching the minefield, they should suffer no attrition from the minefield.

3. The minefields are composed of both AP and AT mines.

4. Conventional minefields are a minimum of 150m in depth.

(c) Minefield characteristics. Minefields are generally characterized by their mine density and length of frontage. Conventional minefields are considered to be a minimum of 150 meters in depth. The algorithm considers standard density minefields. Coverage and width of minefields are determined by gamers in the process of allocating forces to combat.

(d) Sector-minefield geometry. The portion of the attacking force's armored vehicles that will pass through a minefield is determined by the geometric relationships between the force, the sector frontage, and the minefield. The specific relationships of interest are the fractions of the minefield that can and cannot be bypassed by the attacker as described below:

1. The fraction of the minefield that cannot be bypassed is determined subjectively, external to the methodology. This judgment is based on the axis of advance of the attacker with appropriate terrain considerations. The specification of this relationship reduces the amount of minefield frontage through which an attacker must advance.

2. The amount of trafficable terrain in the sector, like the fraction not bypassed, must be qualitatively assessed with military judgment. It is simply an estimate of the amount of terrain (given in meters of width of the sector) that is trafficable to armored vehicles. If it is assumed that the armored vehicles and personnel, if dismounted, are uniformly distributed over the trafficable terrain, the probability that each vehicle or dismounted infantryman encounters the minefield is given by:

$$PCOV = \frac{F_{by} \cdot (MF)}{T_t}$$

where:

$PCOV$ = the probability an attacking weapon system encounters the minefield.
F_{by} = the fraction of the minefield not bypassed.
MF = the minefield frontage in meters.
T_t = the amount of trafficable terrain in meters.

(e) Assessment methodology. The minefield assessments are determined in a linear fashion based on an expected percent of casualties for armored vehicles and personnel that pass through the minefield. The expected percent of casualties varies as a function of mine density for each generic type of mine. The number of armored vehicles and/or dismounted infantry personnel killed as a result of the attacking force passing through a minefield is determined by:

$$MFK_{ik} = N_k \cdot (PCOV) \cdot (FA) \cdot (PERCAS_{ik}/100)$$

where for the kth type of weapon system passing through the ith type of minefield with PCOV as defined above:

MFK_{ik} = the number of weapon systems killed.
N_k = the number of weapon systems in the sector.
FA = the fraction of the attacking force that enters the minefield and is subjected to attrition.
$PERCAS_{ik}$ = the expected percent of casualties for the weapon system passing through the minefield.

Even though an attacker is using "bull" or hasty breach tactics, not all vehicles in his force will be subjected to attrition by the minefield. Instead, the attacker employs only a portion of his weapon systems to clear channels in the minefield through which the remainder of his force passes. This is accounted for in the methodology by gamer input of the FA factor into the preceding equation.

(7) Armor/antiarmor assessments.

(a) General. The armor/antiarmor combat assessment portrays the exchange of fire between the armored and antiarmor elements of the opposing maneuver units. Only tanks, antitank weapons, and selected air defense gun and artillery systems are considered in the actual assessments both as firers and as targets. In addition, armored command vehicles, and armored support vehicles are considered as targets only. Attrition of infantry personnel and materiel, as well as crewmen does result from the armor/antiarmor assessment but only in conjunction with losses of armored vehicles or antiarmor weapons. Losses due to indirect fire, minefields, etc., influence armored combat assessments, only to the extent that the opposing force (weapon system) arrays have been reduced in strength according to the losses suffered. The generalized assessment equation parameterized for single shot kill probabilities and expected number of rounds fired by participating weapons is used to determine actual losses of tanks, other armored vehicles and dismounted antitank weapons.

(b) Assumptions. The following assumptions apply to the armor/antiarmor combat assessments:

1. The weapon systems of the attacker are uniformly distributed throughout a 500-meter-deep range band located some specified distance in front of the defender.

2. The number of rounds fired by engaging systems is a function of the weapon sight, terrain, range, day or night, smoke and dust conditions, suppression, weather, and characteristics of the system.

3. The visibility conditions not only degrade the number of targets to be engaged but also determine the maximum range for engagement.

4. Infantry antitank weapons systems (VIPER, Rattler, RPG-16, and AT-4) are represented based on the number of infantryman participating in the battle (e.g., 1 Rattler per 10 infantrymen).

5. In targeting for direct fire assessments 2/3 of the defender weapon systems are considered to be in hull defilade with 1/3 fully exposed; for the attacking force, 1/3 are in defilade while 2/3 are fully exposed.

(c) Assessments. Given the environmental and military conditions associated with the battle being gamed, the assessment of losses incurred during armor/antiarmor combat is a relatively straightforward process. The assessment equation itself, along with the necessary preliminary computations, is given in the following subparagraphs.

1. Number of targets. The number of each type of weapon system available for targeting is determined by the equation:

$$TGT_k = NW_k \cdot OA_k \cdot VIS \cdot PC \cdot ACQ \cdot SMOKE$$

where, for the kth type target:

TGT_k = the total number of weapon systems targetable.
PC = the percent of targeted force committed.
NW_k = the number of weapon systems remaining in the force array.
OA_k = the operational availability.
VIS = a visibility degradation factor.
ACQ = an acquisition discriminator value for the firing force.
SMOKE = the fraction of unsmoked targets.

The number of weapons remaining in the force array (NW_k) is updated as the battle progresses; that is, the losses incurred during each range increment of the conflict are subtracted from the weapon array before the subsequent assessment begins. The acquisition discriminator parameter (ACQ) used in the equation accounts for the differing capabilities to acquire targets under dissimilar tactical situations. An attacking force, for example, would be expected to acquire targets at a higher rate during a meeting engagement than during an attack on a prepared defensive position.

2. Fire distribution. The distribution of rounds fired at the target array in succeeding range bands is based on a target weighting factor which prioritizes target values among all possible targets. The distribution formula is given by:

$$FDF_k = \frac{NW_k \cdot OA_k \cdot WT_k \cdot SM_k}{\sum_{\text{all } k} NW_k \cdot OA_k \cdot WT_k \cdot SM_k}$$

where, for target type k with NW_k and OA_k as defined above:

FDF_k = the fire distribution factor.
WT_k = the categorized target weighting factor.
SM_k = the percent of unsmoked targets.

The fire distribution factor thus computed determines the number of rounds fired by each type firer at each type target as follows:

$$RND_{ik} = NW_i \cdot OA_i \cdot PC_i \cdot ECF_i \cdot SF_i \cdot FDF_k$$

where, for the ith type firers against type k targets and for NW_i, OA_i, PC_i and FDF_k as defined above:

RND_{ik} = the total rounds fired.
ECF_i = the expected number of completed firings (per weapons).
SF_i = the suppression factor.

The suppression parameter (SF_i) is discussed in section 6.b.(2). The expected number of completed firings (ECF_i) represents the number of rounds a weapon can expect to fire successfully during an exposure of an enemy target at a given range and in a given terrain type and visibility condition. Derivation and source of the actual data are given in reference 48.

3. Assessment equation. The total losses for a given type target are computed by the generalized assessment equation formulation as follows:

$$LOSS_k = \left[1 - \prod_{all\ i} \left(1 - \frac{SSKP_{ik}}{TGT_k} \right)^{RND_{ik}} \right] * TGT_k$$

where, for all firers against kth type targets with TGT_k and RND_k as defined above:

$LOSS_k$ = the total losses.
$SSKP_{ik}$ = the single shot probability.

The single shot kill probabilities for armor/antiarmor are classified and are contained in reference 52. For unclassified processing an arbitrary value of .5 has been assigned to the SSKPs for all weapon systems. The SSKP data in the DAME model are indexed by range, type firer, type target, and target posture. Since the assumption has been made that not all targeted weapons are in the same posture, the SSKP value entered into the equation is a weighted average of two table values rather than a directly extracted value. For the defender force, a 2:1 ratio is assumed between weapons in defilade to those exposed. Thus, the SSKP entered for assessment against a defender's weapon system would be 2/3 of the SSKP against the weapon in defilade plus 1/3 of the SSKP against the weapon fully exposed. For an attacker weapon system, the defilade:exposed ratio is 1:2 so the SSKP used would be 1/3 of the defilade SSKP plus 2/3 of the exposed SSKP.

(d) Infantry/crew losses. Infantry personnel, even when dismounted, are not targets for direct assessment. Dismounted infantrymen are attrited in direct proportion to the infantry-served antitank weapon losses, which are directly assessed. Infantrymen are also attrited when the carriers in which they are riding are killed.

(e) Infantry combat. Infantry combat between dismounted forces is assessed in DAME. Only direct combat between opposing infantry forces is assessed. Attrition of infantry due to indirect fire, attack helicopters, minefields, etc., is assessd in other modules.

1. Assumptions. The following assumptions apply to the infantry combat methodology:

a. Casualty rates are determined by attacker-to-defender firepower ratios.

b. Infantry-served antitank weapons are attrited by the infantry subroutine only when tanks are supporting the infantry combat.

c. No armored vehicles are assessed as losses by infantry combat.

2. Firepower rates. The firepower score for each force is generated by multiplying an infantry weapons factor for each side by the number of infantrymen available for combat. To this number is added the firepower score of any supporting vehicles, such as tanks or carriers. The defender's score is then weighted by a tactical situation factor based on the type of combat, position preparation time, etc. Dividing the two scores yields the attacker to defender ratio.

3. Casualty rates. Casualty rates for the attacking and defending force are then derived using equations derived from the INFANT routine in JIFFY. These equations are classified and may be obtained by contacting the authors of this report.

4. Assessment equation. Assessment of infantry losses is made by the equation:

$$LOSS = (PERS \cdot F)\left[1 - (1 - RATE)^{HR}\right]$$

where for each force:

LOSS = the number of infantry personnel casualties.

PERS = the total infantry personnel in the force array.

F = the fraction of infantry personnel committed to combat.

RATE = the personnel casualty rate.

HR = the length of battle.

This equation is applied separately to each of the opposing forces. The fraction F, of personnel committed to battle, a value between 0 and 1, together with the total infantry personnel, PERS, in the force array determine the number of personnel available for attrition. This factor is applied to both forces and allows for gaming situations in which only a portion of each infantry force in a sector is expected to enter the conflict. The length of a battle, HR, can be no more than 6 hours; the actual number of hours entered is prescribed by the situation being gamed. There is no factor for suppression in the equation; suppression was considered in the development of the casualty rates and thus is inherent in the RATE values.

(8) Attack helicopter assessments. Attack helicopters are assessed in DAME using the generalized assessment equation.

(a) Assumptions. The attack helicopter methodology is subject to the following assumptions:

1. Helicopters fire only at vehicle systems and use only missile munitions.

2. A sortie consists of one takeoff and one landing of an aircraft from a base or servicing facility. Sorties are generated and allocated according to manual rules discussed previously.

3. Allocation of helicopter fire against a ground target is based on the target's importance relative to other targets. A weighted value based on firepower score is used to establish target value. Fire distribution is identical to that used in previous sections.

4. Helicopter losses are manually determined as described in the attrition rules section.

(b) Target arrays. The number of targets for helicopter assessment is given by:

$$TGT_k = NW_k \cdot OA_k \cdot FE \cdot PSN \cdot SMK_k \cdot L_k$$

where for target type k:

TGT_k = number of targets available

NW_k = number of weapons alive

FE = fraction of forces engaged

OA_k = operational availability

PSN = tactical deployment factor

SMK_k = fraction of unsmoked targets

L_k = armament load utilization factor

(c) Rounds expended. The number of rounds expended is given by:

$$RDS_k = AR \cdot FSMK_k \cdot ADJST \cdot ABORT$$

where for target type k

RDS_k = number of rounds fired

AR = number of rounds available

FSM_k = fraction of helicopters unsmoked

ADUST = dust degradation factor

ABORT = missile abort factor

(d) Ground losses. The general assessment equation as applied to helicopter assessments of ground forces is

$$GFKILL_k = \left[1 - \left(1 - \frac{SSKP_k}{TGT_k}\right)^{RDS_k}\right] * TGT_k$$

where for target type k

$GFKILL_k$ = number of targets killed

$SSKP_k$ = single shot kill probability

TGT_k = number of targets

RDS_k = number of rounds fired

(9) Loss apportionment. Losses determined to Red and Blue forces are apportioned to the participating units in direct proportion to the number of systems contributed by a unit to the sector. For example, if a task force contributed 40% of all tanks to the sector battle, then 40% of all tank losses would be apportioned to that unit.

c. Logistics Module. The logistics module couples gamer input of resupply tonnages and unit mission profiles with a set of consumption factors to keep track of Class III (fuel) and Class V (ammunition) supplies within the units played in DAME. Two separate categories of supplies are recorded. The first is the fuel and ammunition level on unit combat vehicles. The second is the amount of supplies carried on the cargo vehicles of the unit. The amount of these supplies is varied according to game play and a status update is maintained. A brief description of the methodology follows.

(1) Assumptions.

(a) Unit level resolution is specified for all logistics calculations in the module. This includes fuel and ammo status of combat vehicles and distribution of supplies among resupply vehicles. The status computed for supply levels is the average for all vehicles in the unit.

(b) Fuel and ammo resupply from unit cargo vehicles to unit combat vehicles is assumed. Fuel and ammunition will be transferred to combat vehicles from unit cargo vehicles as long as spare supplies are available.

Combat vehicle supplies will fall below full capacity only after unit supplies are exhausted.

(c) A vehicle's fuel and ammo are lost when the vehicle is destroyed. This includes supplies carried on cargo vehicles.

(d) A generic cargo vehicle is used for logistic assessments. For Blue, the cargo vehicle is either a 10-ton truck or a 2500-gallon tanker. For Red, the cargo vehicle is a 2210-gallon tanker or an 8.8 ton cargo vehicle.

(e) Cargo vehicle losses are divided between ammunition and fuel carriers in proportion to the number of those vehicles that are present for assessment.

(f) Ammunition and fuel consumption are computed before combat attrition is assessed in the game turn. This portrays the supply consumption of all vehicles instead of computing only the consumption of surviving vehicles.

(g) All ammunition and fuel is considered to be stored on cargo vehicles. Ground storage is not portrayed.

(2) Gamer inputs. As previously described the gamer must specify two mission profiles for a unit during a 6-hour game turn. Nine mission profiles are available from which to choose. The gamer must also manually determine the tonnage of ammunition and the amount of fuel (gallons) which is received by the unit during the game turn. These procedures are described in the section on logistics gaming operations.

(3) Methodology. The methodology used in the logistics module is very straightforward. The status of each unit played in the game is computed individually. The sequence of actions is:

(a) Logistics program.

1. The amount of fuel and ammunition presently on hand is computed. This amount is the sum of individual vehicle levels, the amount carried by the cargo vehicles, and the amount resupplied during the game turn.

2. The amount of fuel/ammunition consumed is then computed. This is the sum of the consumption of all unit vehicles for the given unit mission and the amount of supplies that are dispensed to other units.

3. The total amount of fuel and ammunition remaining is then computed. This is the amount available minus the amount consumed.

4. The status of unit vehicles and the amount of ammunition and fuel on cargo vehicles (if any) are computed.

(b) Consolidation program. A consolidation program is run at the conclusion of the attrition in the game turn. This program revises the amount of ammunition and fuel on cargo vehicles based on attrition to those vehicles to insure that vehicles are not overloaded.

(4) Data generation. The generation of consumption rates for all the vehicles portrayed in the game is an essential element of the logistics module. Hourly consumption rates for fuel and daily expenditure rates for ammunition were obtained from various Army 86 source documents (ref 59). These rates were then mapped into the mission profiles to generate consumption rates to be used in the model. Three hour periods were used for mission duration as this time span was felt to best represent a logical time span for mission execution.

d. Detection Module. The DAME detection model attempts to portray the detection of units and the intelligence fusion process necessary to recognize unit type and location. The model requires gamer inputs describing the location of each enemy sensor group covering the unit. Output from the model consists of a list of units which have been detected (simply found but not fully identified), verified (found, identified and being tracked) or lost (previously verified/detected but now lost). The list represents the intelligence map held by the friendly commander. In essence it is his view of the battlefield with respect to enemy units and is intended to be used as a basis for his decision to tactically respond to these units. The model provides one list for the Blue commander and one list for the Red commander.

(1) Processes. In simulating the production of the commander's intelligence map, the model considers three processes.

- The ability of the friendly sensors to detect individual elements of the enemy unit.

- The intelligence fusion process whereby numbers of detected enemy elements are mapped into the detection of enemy units by friendly personnel.

- The degradation and updating of the intelligence map in terms of loss of unit detectors due to target movement.

The following paragraphs provide a description of the methodology, assumption, and data bases used by the model to represent each of these processes.

(2) Calculations. Calculation of element detection by sensor groups considers elements of target units to be divided into five categories: personnel, armored combat vehicle, support vehicles, artillery, and large rockets. Target units and their associated elements can be located in one of five range bands from the sensors. In order to simplify game play, location of sensor groups is represented on the map board. Sensor groups consist of one or more individual sensors of varying types. Sensors in a group have

individual detection probabilities limiting their range effectiveness. However, the model assumes that an individually exposed target element is covered by all sensors in the group having an effective range to that element. The probability of the sensor group detecting an individual element is given by:

$$P_{Ge} = 1 - \prod_{\text{all } i} \left(1 - P'_{ie}\right)^{n_i}$$

where:

P_{Ge} = the probability that an exposed element of type e is detected by sensor group G.

P'_{ie} = the probability that sensor i can detect element e.

n_i = the number of sensors of type i in group G.

As mentioned in the previous paragraph, the probabilities of detection P'_{ie} are range dependent and hence the probability of group detection P_{Ge} is also range dependent. The sensor detection probabilities P_{ie} were developed from sensor performance parameters found in the Target Acquisition Study (TAS II) conducted by CAA in 1980. The data is classified and will not be presented in this document. However, it should be noted that the probabilities include the following parameters.

$$P'_{ie} = P_{ie} \cdot P_{los} \cdot P_a \cdot P_c \cdot P_j \qquad (2)$$

where:

P_{ie} = the probability that sensor i can detect element e, given that the element is exposed and the sensor is functioning.

P_{los} = probability the sensor has line of sight to the target. In cases where sensors do not require line of sight this probability is set to 1.

P_a = probability that the sensor is available at the moment the target is exposed.

P_c = probability that the crew manning sensor will recognize the sensor representation of the target element.

P_j = probability that sensor is not jammed.

The jamming probabilities are currently input estimates supplied by the gamer.

(3) Intelligence fusion process.

(a) The ability of the friendly force to recognize a unit from sensor detections of individual elements is represented in the model by two processes. The first process describes the exposure profile of the target unit. The second process calculates the probability that the unit will be recognized by intelligence personnel and correctly categorized as one of 10 unit types.

(b) The exposure profiles for individual elements in a unit are shown in Table 8-1. All target unit elements in the DAME units file are categorized by the detection model as one of five signature types. The exposure percentages shown in Table 8-1 are then applied to the sum of the unit elements giving the number of elements exposed to the sensors. Table 8-1 was developed by the DAME project team using military judgment. It represents an effort to relate an element exposure profile to the unit mission.

(c) Tables 8-2 and 8-3 are percentages which are applied to the numbers of exposed target elements. The resulting numbers of elements are intelligence thresholds used by the model to simulate the fusion process of identifying a unit from its parts. The example in Figure 8-1 provides an overview of the use of Tables 8-1 and 8-2 by the model. A Blue battalion executing a "move" mission has the number of elements as shown in the DAME unit file. These elements are then categorized into the six types shown in step 1. In the second step, the model extracts the exposure profile percentages for a "move" from Table 8-1 and calculates these numbers of elements exposed to that sensor group. In step 3, the intelligence profile is extracted from table 8-2 and applied to the exposed elements to generate the numbers of unit elements representing intelligence thresholds. These represent the number of elements which must be detected before the intelligence map is posted with a unit detection. In the example 2 personnel, 5 vehicles, 22 tanks, and 2 artillery pieces must be detected before the unit will be detected as a battalion.

Table 8-1. Fractional target exposure criteria. (Target fractions which are exposed in various mission postures.)

	Target Element Categories				
Mission	Personnel	Vehicles	Tanks/APC	Artillery	Rockets
Attack	.40	.75	.75	.75	.75
Defend	.10	.30	.30	.60	.50
Reserve	.30	.40	.40	.60	.50
Move	.10	.65	.65	.60	.50

SOURCE: Reference 30.

Table 8-2. Red intelligence thresholds. (Fraction of exposed Blue elements which must be detected to correctly associate elements with Blue unit types.)

	Target Element Categories				
Unit Type	Personnel	Vehicle	Tanks/APC	Artillery	Rockets
Combat	.20	.40	.50	.50	.40
Artillery	.20	.40	.50	.50	.40
ADA	.20	.40	.60	.50	.40
AH Gnd	.20	.40	.20	.20	.40
CP	.20	.30	.40	.20	.40
Engr	.20	.40	.60	.20	.40
POL/Ammo	.20	.45	.80	.20	.40
Maint	.20	.50	.40	.20	.40
SAM	.20	.30	.20	.30	.40
Radar	.20	.40	.10	0	.40

SOURCE: Reference 25.

Table 8-3. Blue intelligence thresholds. (Fraction of exposed Red elements which must be detected to correctly associate elements with Red unit types.)

	Target Element Categories				
Unit Type	Personnel	Vehicle	Tanks/APC	Artillery	Rockets
Combat	.20	.25	.35	.30	.40
Artillery	.20	.25	.35	.35	.40
ADA	.20	.30	.35	.30	.40
AH Gnd	.20	.35	.20	.20	.40
CP	.20	.30	.40	.20	.40
Engr	.20	.25	.40	.20	.40
POL/Ammo	.20	.40	.40	.20	.40
Maint	.20	.40	.40	.20	.40
SAM	.20	.30	.20	.30	.40
Radar	.20	.40	.10	0	.40

SOURCE: Reference 61.

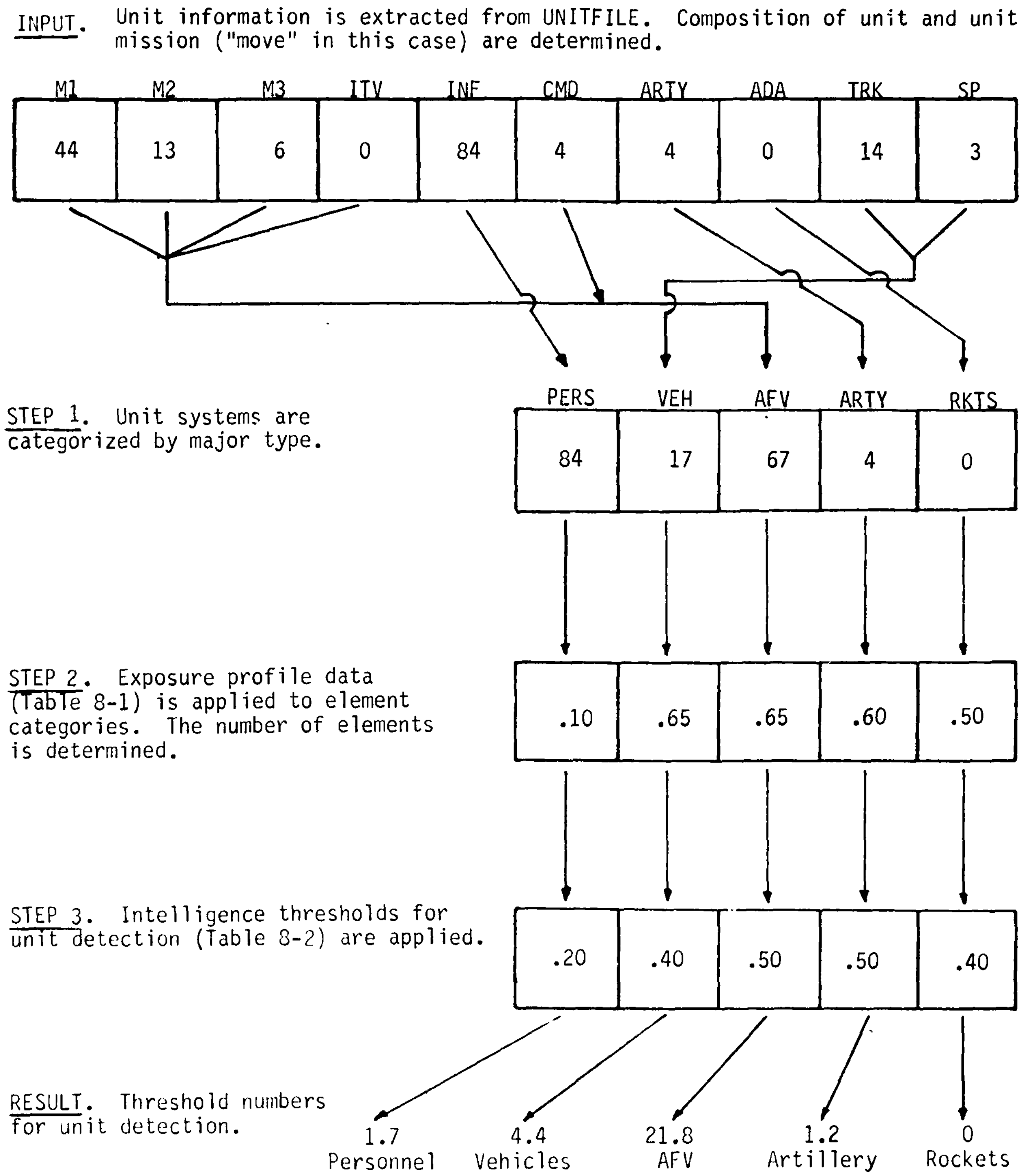

Figure 8-1. Determination of detection thresholds for an Armor Task Force.

(d) The detection model uses a normal approximation of the binomial distribution to calculate the probability of detecting at least the threshold number of elements in each category in the following manner.

$$P_{ce} = 1 - \Phi\left(\frac{T_e - \overline{X}_e}{\sigma_e}\right)$$

where:

P_{ce} = Probability that the intel personnel receiving reports from sensor group c will detect enough category e elements to identify the unit.

$\Phi(X)$ = the cumulative normal density function evaluated to X.

T_e = the number of threshold elements of category e needed to detect the unit.

$\overline{X}_e$, σ_e = the mean and standard deviation of the normal approximation to the binomial distribution.

T_e is represented by;

$$T_e = S_e \cdot E_e \cdot I_e \cdot Z \quad (4)$$

where:

S_e = the sum of elements of type e in the unit.

E_e = the fraction of elements of type e exposed under the current mission (See Table 8-1).

I_e = the minimal fraction of elements of type e which must be detected before the unit can be detected (See Tables 8-2 and 8-3).

Z = a factor adjusting the intelligence threshold for units which were previously detected but are now lost. Z = 1.0 for units not previously detected and 0.75 for units lost during tracking.

$\overline{X}_e$ is represented by;

$$\overline{X}_e = S_e \cdot E_e \cdot P_{Ge} \quad (5).$$

where:

S_e and E_e are as described above.

P_{Ge} = Probability that sensor group G will detect an element of type e.

σ_e is represented by:

$$\sigma_e = S_e \cdot E_e \cdot P_{Ge} \cdot (1-P_{Ge})$$

where:

S_e, E_e, P_{Ge} are as described above.

The detection model calculates P_{Ge} for each element category within the unit. These probabilities are used in a Monte Carlo evaluation to determine which categories are detected within the unit. Units are "detected" and posted on the intelligence list if one-half or more of their element categories are detected.

(e) The use of target exposure profiles (Table 8-1), intelligence detection profiles (Tables 8-2 and 8-3) and the normal binomial approximation structure has some inherent assumptions and limitations. The reader is reminded that due to a paucity of field data, Table 8-1 was developed using military judgment. The underlying assumption in the use of this table is that the unit mission (not the unit type) describes the level of concealment the unit is able to achieve. Tables 8-2 and 8-3 are totally subjective in nature. They were also developed by the DAME programming team using military judgment. They were built under the assumption that a good intelligence officer will identify units with some a priori knowledge of their type and mission. He will have maps to estimate reasonable deployment areas and some knowledge of enemy force structures to guide him in use of sensor reports. Finally the use of the normal approximation of the binomial distribution works well when units have several elements. In a battalion/regimental game where most categories have more than 10 elements, it is adequate. Care should be used in applying it to smaller units.

(4) Unit losses and unit verification.

(a) Following the detection of a target unit, the model also represents the tracking of that unit by the sensor groups. Units are allowed to change positions to avoid detection at a tactically realistic rate. Table 8-4 contains the unit movement profile showing the time intervals at the end of which a unit will purposefully move to confuse the sensors. This table was also based on data used in the TAS II study. This movement should not be confused with a "move" mission where a unit is required to travel to another point on the battlefield. The avoidance movement is merely a changing of positions while maintaining the same mission and staying in the same tactical area. The model uses the following set of automated rules to represent tracking of detected units.

1. Units that are detected remain detected until they move.

2. Units that move to avoid detection must be redetected following their movement.

3. Units that are executing a move mission must be redetected every 3 hours.

Table 8-4. Time intervals between unit movements to avoid detection.

Blue Unit Type	Stationary Time (Hours)	Red Unit Type	Stationary Time (Hours)
Combat Unit	2	Combat Unit	2
Arty Unit	3	Arty Unit	4
ADA Unit	3	ADA Unit	3
AH GND Site	3	AH GND Site	3
CP/HQ	2	CP/HQ	6
Engr Unit	4	Engr Unit	6
POL/AMMO Supply	12	POL/AMMO Supply	12
Maint. Pt.	24	Maint. Pt.	24
SAM Site	24	SAM Site	24
RADAR/EW		RADAR/EW	6

SOURCE: Reference 61.

4. Previously detected units that are not redetected during a move are placed in a "lost" status for 3 hours. If not redetected during the next 3 hours they are moved to an "undetected" status and are removed from the intelligence list.

5. Detection thresholds are lowered to 75% of their normal values for redetecting moving units or units in a "lost" status.

(b) The model represents three states of unit detection;

1. Detected - a unit has been found and its type has been identified. Its mission, exact location, and strength are unknown.

2. Verified - The type and exact location of a unit are known. A reasonable estimate has been made of unit mission and strength.

3. Lost - A previously detected or verified unit has been lost during a move. The (within 3 hours) position and unit type are known.

The model moves units from a "detected" to "verified" status if detection is maintained for 4 hours.

(5) Other capabilities of the detection model. The previous paragraphs have described the principal methodology used in building the DAME target intelligence maps. This methodology is applied to both Blue and Red unit files during each 3-hour period of the game. The model has three other features representing special intelligence situations which also impact the target hits.

(a) Begin game for Red/Blue. This feature initializes the target detection list and represents accumulated intelligence knowledge at the beginning of the game. The methodology is a simplified version of the one described above. Sensor groups and intelligence thresholds are ignored and replaced with tabular probabilities representing unit detections as a function of unit range from the forward line of own troops (FLOT). The unit detection probabilities were taken from the results of the TAS II Study. This feature of the model should be utilized only when 12-24 hours of intelligence is required preceding the start of a game.

(b) Update intelligence for Blue/Red units in contact. The previous paragraphs have described a methodology for the detection of units which are at ranges beyond the visual capabilities of localized battalion personnel. However, when battalions are within 10km of enemy units they are considered to be in contact by the DAME intelligence module. This is represented in the model by a special data base representing detection probabilities of long range reconnaissance patrols against elements of enemy units. The methodology for calculating detection of enemy units is the same as that listed in paragraph (3) above.

(c) Red commander's verification of Blue units. One of the critical aspects of the deep strike game is Red's ability to identify Blue units operating in his rear area. It was believed that Red players would require a special representation of the sensor elements directly under the control of the Red commander. Specifically, air reconnaissance assets would probably be used by the Red commander to "verify" the presence of Blue units having a "detected" status operating in his rear area. In order to simulate this, the model uses probabilities of element detection representing airborne photo assets flying over a detected Blue unit. Any Blue unit redetected by the airborne units is immediately posted as "verified" on the Red commander's intelligence map. The methodology for unit identification is identical to that described in paragraph (3) above.

e. Chemical Module. The DAME Chemical Module generates unit casualties from battalion and battery volleys of persistent and non-persistent chemical agents. The chemical attrition in DAME is a table look-up process based on gamer inputs. The following contains a description of the assumptions, the methodology, and the data development of the DAME Chemical Module. Appendix B contains the computer listing, a file description, and a variable definition list.

(1) Assumptions. The assumptions used in the DAME Chemical Module are:

(a) Both persistent and non-persistent are used, but only a single agent of each type is considered.

(b) The means of delivery are Blue 155mm howitzer and Red 152mm artillery.

(c) Chemical assessments are made using either a battery or a battalion volley.

(d) Only units out of MOPP 4 are attrited.

(e) Masking and alert time is considered to be approximately 30 seconds.

(f) Only the primary effects of the chemical agents are considered.

(2) Methodology. The following explains the logical flow of the chemical module program:

(a) The gamer inputs the firing force: Blue or Red, battery or battalion, persistent or non-persistent chemicals,

(b) Based on the above inputs, four files are retrieved from the database. The four files contain casualty fractions representative of the four possible mission profiles (See DAME Unit File element 21, App A). Each of the files contains a table of casualty fractions based on the 10 elements of a unit (See Unit File elements 1-10) and five possible target radii (100-500 meters).

(c) A target radius file is also retrieved from the database and is based on the 10 possible unit types and four possible mission profiles (See unit File element 21 and 24). The target radius table contains five possible radii (100-500 meters).

(d) The gamer then inputs the following: target unit number, percentage of the target unit affected by chemicals, MOPP status, and the number of missions assessed against the target. Only targets out of MOPP can be assessed.

(e) Given the mission profile and the unit type, the target radius is determined from the target radius table.

(f) Given the firing force, the mission profile, and the target radius, casualty fractions of the 10 elements are then determined from the proper casualty fraction file.

(g) Losses for each element of the target unit are then determined by multiplying the casualty fraction, the number of elements, and the percentage of the target unit affected by chemicals.

(h) The number of systems killed for each force is then updated and stored in the Blue and Red chemical victim files.

(3) Data development. Below is a brief derivation of the casualty fraction data and the target radius data.

(a) Casualty fraction data for the 10 weapons systems at five target radii (100, 200, 300, 400, 500 meters) were obtained from FM 101-6-4, FM 101-60-2 and FM 3-10-1 Draft (See references). The data were weighted by mission profile (See Unit File element 21) and three protective categories: (1) Open, (2) Open foxholes and vehicles, and (3) Closed foxholes and vehicles.

(b) Target radii for the 10 unit types and four mission profiles were also determined from the above documents. The target radii give the expected size of the target given its current mission.

Appendix A. DAME Unit File

1. General. The DAME Unit File is used to maintain the status of units played in the model. This dynamic file maintains a record of all unit characteristics and allows various status parameters to be updated as the game progresses. The file uses random access and contains 120 records, one for each unit, and is accessed using the unit number. Each record contains 34 data items, structured into a one-dimensional array (variable name "N"). A complete description of each data items is contained in the following paragraph.

2. Element Description.

Number	Name Value	Default	Description
(1)	M1/T80	0	Elements 1-10 describe the number of each type of equipment available to the unit.
(2)	M2/BMP	0	
(3)	M3/BTR	0	
(4)	ITV/BRDM-2	0	
(5)	Infantry/Infantry	0	
(6)	Cmd Veh/Cmd Veh	0	
(7)	Arty/Arty	0	
(8)	ADA/ADA	0	
(9)	Cargo Trucks/Cargo Trucks	0	
(10)	Special/Special	0	
(11)	Effectiveness	0	The force effectiveness calculated from the firepower score.
(12)	Intelligence Status	0	Total hours this target has been tracked during this detection.
(13)	Mission Status (X.Y)	0.0	Represents Blue/Red missions during current 6-hour period. One of 10 missions may be applied in each 3 hour periods. X = Mission first 3 hours Y = Mission second 3 hours

Mission Number	Description
0	Destroyed/Ineffective
1	Reserve (Idle)
2	Lt Defense
3	Med Defense
4	Heavy Defense
5	Lt Atk
6	Med Atk
7	Heavy Attack
8	Move 40 km
9	Move 80 km

NUMBER	NAME	DEFAULT VALUE	DESCRIPTION
(14)	Detection Status (X.Y)	0.0	X = Represents hours left until redetected. Y = Represents the unit status with respect to detection by the opposite Commander. 0 = Not detected. 1 = Detected but not verified. 2 = Acquired/verified. 3 = Lost
(15)	POL Status	0	Total fraction of POL currently in vehicle fuel tanks.
(16)	Ammo Status	0	Fraction of short tons of ammo currently on combat vehicles.
(17)	Ammo Resupplied	0	Number of short tons resupplied during last 6 hours.
(18)	POL Resupplied	0	Number of gallons resupplied during last 6 hours.
(19)	Ammo Consumed	0	Total ammo consumed CI.
(20)	POL Consumed	0	Total POL consumed during CI.
(21)	Major Mission	3	Major mission used for detection profile: 1 = Attack 2 = Defend 3 = Reserve/Idle 4 = Move
(22)	Sensor Status (X.Y)	1.4	X = POTA zone values (1-5) for sensor group Y. Y = Sensor group (0-4) detecting this particular unit. 0 = Not covered 1-3 = applicable Blue/Red sensor group 4 = Linear FEBA-oriented sensor array
(23)	Unit MOPP Level		1 = Unit not in MOPP 2 = Unit in MOPP

NUMBER	NAME	DEFAULT VALUE	DESCRIPTION
(24)	Unit Type (X.Y)	1.0	X = Player ID 1 = Blue 2 = Red Y = Unit type Blue/Red Units 0 = Combat Unit 1 = Arty Unit 2 = ADA Unit 3 = AH Gnd Site/FARP 4 = CP/HQ 5 = Engr Unit 6 = POL/Ammo Supply Pt 7 = Maint Pt 8 = SAM site 9 = Commo/Radar/EW Site
(25)	Fuel on hand (X.Y)	0.0	Fuel (gal) on hand at end of CI. X = on combat vehicles Y = on tankers
(26)	Ammo on hand (X.Y)	0.0	Ammo (STONS) on hand at end of CI. X = on vehicles Y = on cargo
(27)	Fraction of trucks (element 9) which are POL tankers	0.0	
(28)	Number km traveled by unit this CI	0.0	
(29)	Fr unit covered by sensor slice	1.0	
(30)	Beginning number trucks (element 9) this CI	0.0	
(31)	POL dispensed by Supply Pt	0.0	
(32)	Ammo dispensed by Supply Pt	0.0	
(33)	Not used	0.0	
(34)	Activity Code	0.0	1 = Active unit in game. 0 = Not played.

Appendix B. Computer Listings

1. General. This appendix presents the code listings for all of the sub-programs used in DAME. Each is formatted to present variable names, computer code, and information about required file structures. In keeping with the unclassified nature of the report no classified data is presented.

2. Control Program. The DAME control program allows the user to select from a menu of programs to process game operations in DAME.

a. Variable listing.

Y$	Program number required.
Z$	Program name for disk use.

b. File Structures. None required.

c. Data Requirements. None.

```
100 REM- 'DAME' IS THE MENU CONTROL PROGRAM FOR THE DEEP ATTACK
110 REM-    MAP EXERCISE ALGORITHMS.  CODED BY CPT REISCHL, OAB,
120 REM-    CAORA.  TELEPHONE A/V 552-4613/5122.  20 JAN 83.
130 INIT
140 PRINT 'L         DEEP ATTACK MAP EXERCISE'
150 PRINT '                    MENU'
160 PRINT 'J1.    GROUND COMBAT MODULE'
170 PRINT 'J2.    DATA ENTRY MODULE'
180 PRINT 'J3.    CHEMICAL MODULE'
190 PRINT 'J4.    LOGISTICS MODULE'
200 PRINT 'J5.    DETECTION MODULE'
210 PRINT 'J6.    GAME TURN SUMMARY MODULE'
220 PRINT 'J7.    AIR LOSS ASSESSMENT MODULE'
230 PRINT 'J8.    GAME PREPARATION MODULE'
240 PRINT 'J9.    GAME POSTPROCESSOR MODULE'
250 PRINT 'J10.   TOE FILE PREPARATION MODULE'
260 PRINT 'J11.   SENSOR GROUP PREPARATION MODULE'
300 PRINT 'JJ     ENTER DESIRED PROGRAM NUMBERJ'
310 INPUT Y$
320 Z$='P'&Y$
330 PRINT 'LG LOADING PROGRAM ';Y$
340 OLD Z$
350 RETURN
```

3. Ground Combat Program (Part 1). DAME's ground combat program (Program 1 on the DAME menu) is divided into 2 programs which overlay each other. The overlay is transparent to the user, but for clarity the individual programs are considered here. Part 1 of the combat program covers sector input, rate of advance calculation, minefield and attack helicopte attrition.

a. Variable listing.

A — Advance rate (matrix array)
A0 — Advance rate
A1,A9 — Advance rate file pointer
B(I) — Sector combat parameters, the I values correspond to:

- 1 = Sector ID (Turn#.Sector#)
- 2 = Attacker (0 = Red, 1 = Blue)
- 3 = Mission type for defender
  - 1 = meeting engagement
  - 2 = delay
  - 3 = withdraw
  - 4 = defend fortified
  - 5 = defend prepared
  - 6 = defend hasty
  - 7 = indirect fire only
- 4 = Blue terrain type
  - 1 = open
  - 2 = rolling
  - 3 = hilly
  - 4 = mountainous
- 5 = Red terrain (same categories as 4)
- 6 = Type attack
  - 1 = mounted
  - 0 = dismounted
- 7 = Light conditions (day=0, night=1)
- 8 = Initial attacker range band (1-6)
- 9 = Barriers (0 = no, 1 = yes)
- 10 = Infantry Dismount? (0 = no, 1 = yes)
- 11 = Total Km advanced
- 12 = Advance rate per hour
- 13 = Attacker/defender force ratio
- 14 = Length of combat (hrs)
- 15 = Direct fire firepower ratio
- 16 = Final attacker range band
- 17 = Percent Blue committed
- 18 = Percent Red committed
- 19 = Blue MOPP/fatique degradation
- 20 = Red MOPP/fatique degradation
- 21 = Mines played? (0 = no, 1 = yes)
- 22 = Sector width
- 23 = Minefield width

24 = Fraction of minefield not bypassed
25 = Fraction of attack force entering minefield
26 = Minefield type (1-conventional, 2-FASCAM)
27 = Battle type (1-conventional, 2-rear area)
28 = Visibility index
29 = Blue direct fire ADA/arty percent (ADA.Arty)
30 = Red direct fire ADA/arty percent (ADA.Arty)

C(I)	Indirect fire parameters, where I values are 1 = Number of Blue battery missions available. 2 = Number of Blue attack helicopter sorties available. 3 = Number of Blue CAS sorties availble. 4 = Number of CLGP missions available. 5 = Number of Red artillery battery missions available. 6 = Number of Red attack helicopter missions available. 7 = Number of Red CAS sorties available. 8 = Number Blue batteries in direct support role. 9 = Number Red batteries in direct support roles. 10 = Percent Blue/Red DS missions (Blue.Red)
C1,C2	Blue/Red indirect fire systems firepower scores
F	Advance rate pointer
F0	System firepower scores (array)
F2,F3 F4,F5	Intermediate firepower score variables
L	Target exposure table (array)
M	Initial/surviving equipment matrix
M0	Minefield coverage fraction
M9	Minefield casualty fraction (array)
N	Unit status parameters (see App A)
O	Sector unit list (array)
O1	Input matrix (array)
O2	System loss array
Q	Operational availability fraction (array)
R	Rounds expended at target i
S	SSKP matrix (array)
S0	Blue SSKP
S1	Red SSKP
S8,S9	Intermediate SSKP
S3	Suppression factor by type vehicle (array)
T	Available target matrix (array)
T0,T9	Fire distribution variables
V1,V2	Blue/Red killer victim table (array)
W	Military worth factor
W1	Mission specific firepower score weighting factor (array)
X1,X2	Red/Blue KV tables, used in game file
X9	Input error indicator

b. File Structures Used (all on disk #0).

Name	Type	# Rec/Length	Remarks
UNITFILE	Random	120/340	Unit status (see App A)
SECTDATA	Sequential	na/2000	Parameters for use in 2nd combat program
ADVRATE	Random	48/150	Rates of advance
MILWORTH	Random	13/185	Target value file
SSKP	Random	14/910	SSKP files for direct fire, indirect fire, attack helicopters

c. Data Used.

Data	Location	Remarks
Advance rates	ADVRATE	Derived from JIFFY III methodology. 48 records hold data based on terrain, mission, visibility, force ratio.
Target value	MILWORTH	Target worth of artillery, direct fire, and attack helicopter targets is categorized by range band (for direct fire), type fire, conventional or rear area combat.
Single shot kill probabilities	SSKP	SSKP (classified) are kept for all attrition in 10x10 matrices. Records 1-12 are for direct fire. Record 13 is for attack helicopter. Record 14 is for artillery and CLGP. Direct fire entires are in form FE.HD where FD = fully exposed SSKP in percent HD = hull defilade SSKP in percent
Minefield fractional casualties	array M9	Derived from JIFFY III data (classified)
Vehicle operational availability	array Q	As listed
Defender firepower score adjustment	array W1	As listed

```
100 REM-"P1" IS THE 1ST PROGRAM IN THE GROUND COMBAT MODULE
110 INIT
120 DIM N(34),V1(5,10),M(4,10),M9(2,10),A(16),O2(10),T(2,10),W(2,10)
130 DIM B(30),V2(5,10),O(2,10),Q(2,10),S(10,10),W1(2,7)
140 DIM C(10),O1(10),Y$(1),FO(4,10),C1(2),C2(2)
150 OPEN "UNITFILE";1,"F",Z$
160 REM-INITIALIZE
170 GOSUB 370
180 REM-INPUT SECTOR FORCES
190 GOSUB 660
200 REM-INPUT SECTOR PARAMETERS
210 GOSUB 1310
220 REM-COMPUTE RATE OF ADVANCE
230 GOSUB 1470
240 REM-COMPUTE MINEFIELD ATTRITION
250 GOSUB 2090
260 REM-COMPUTE ATTACK HELICOPTER ATTRITION
270 GOSUB 2260
280 REM-CLOSE OUT AND TRANSFER DATA
290 OPEN "SECTDATA";3,"F",Z$
300 ON EOF (3) THEN 320
310 WRITE #3:B,C,V1,V2,M,O,Q
320 CLOSE 3
330 CLOSE 1
340 PRINT "GLLOADING ATTRITION PROGRAM"
350 OLD "P1A"
360 END
370 REM-INITIALIZE
380 B=0
390 C=0
400 V1=0
410 V2=0
420 O1=0
430 O=0
440 M=0
450 N=0
460 A=0
470 F=0
480 W=0
490 RESTORE 510
500 READ Q
510 DATA 0.78,0.81,0.81,0.81,1,0.81,0.76,0.75,0.83,0.83
520 DATA 0.78,0.81,0.81,0.81,1,0.81,0.61,0.85,0.83,0.83
530 S=0
540 O2=0
550 RESTORE 570
560 READ M9
570 DATA 1,1,1,1,1,1,1,1,1,1
580 DATA 1,1,1,1,1,1,1,1,1,1
590 F2=0
600 F4=0
610 RESTORE 630
```

```
620 READ W1
630 DATA 1,1,0.5,2,1.7,1.5,1
640 DATA 1,1,1,1,1,1,1
650 RETURN
660 REM-INPUT SECTOR FORCES    ****
670 PRINT 'LDAME GROUND ATTRITION'
680 PRINT 'JENTER FORCE OPTION:    1-MULTIPLE UNITS'
690 PRINT '                        2-INDIVIDUAL SYSTEMS'
700 INPUT Z0
710 IF Z0<>1 AND Z0<>2 THEN 670
720 PRINT 'JENTER BLUE UNIT #'S AND FRACTION AVAILABLE (MAX=5)'
730 INPUT O1
740 FOR I=1 TO 10
750 O(1,I)=O1(I)
760 NEXT I
770 O1=0
780 PRINT 'JENTER RED UNIT #'S AND FRACTION AVAILABLE (MAX=5)'
790 INPUT O1
800 FOR I=1 TO 10
810 O(2,I)=O1(I)
820 NEXT I
830 REM-CHECK FOR ERRORS
840 GOSUB 2740
850 IF X9=1 THEN 670
860 IF Z0=1 THEN 1030
870 REM-ENTER NUMBER OF SYSTEMS
880 O1=0
890 PRINT 'JENTER # OF BLUE SYSTEMS 1-10'
900 INPUT O1
910 FOR I=1 TO 10
920 M(1,I)=O1(I)
930 M(2,I)=O1(I)
940 NEXT I
950 O1=0
960 PRINT 'JENTER # OF RED SYSTEMS 1-10'
970 INPUT O1
980 FOR I=1 TO 10
990 M(3,I)=O1(I)
1000 M(4,I)=O1(I)
1010 NEXT I
1020 GO TO 1200
1030 REM-TOTAL UP UNIT WEAPONS
1040 FOR I=1 TO 9 STEP 2
1050 IF O(1,I)=0 THEN 1120
1060 ON EOF (1) THEN 1080
1070 READ #1,O(1,I):N
1080 FOR J=1 TO 10
1090 M(1,J)=M(1,J)+N(J)*O(1,I+1)
1100 M(2,J)=M(1,J)
1110 NEXT J
1120 IF O(2,I)=0 THEN 1190
1130 ON EOF (1) THEN 1150
1140 READ #1,O(2,I):N
```

```
1150 FOR J=1 TO 10
1160 M(3,J)=M(3,J)+N(J)*O(2,I+1)
1170 M(4,J)=M(3,J)
1180 NEXT J
1190 NEXT I
1200 REM-PRINT SECTOR UNITS
1210 PRINT 'LSECTOR UNITS AND WEAPONS   (ENTER 999 IF INCORRECT)'
1220 PRINT 'JUNITS:'
1230 PRINT USING 1240:O
1240 IMAGE 2[5[3D,1X,1D.2D,3X],/]
1250 PRINT 'WEAPONS:'
1260 PRINT USING 1270:M
1270 IMAGE 4[10[4D.1D,1X],/]
1280 INPUT Z1
1290 IF Z1=999 THEN 160
1300 RETURN
1310 REM-ENTER SECTOR PARAMETERS    ****
1320 PRINT 'JENTER 3 ROWS OF SECTOR PARAMETERS'
1330 PRINT 'ROW 1'
1340 INPUT B(1),B0,B(2),B(3),B(4),B(5),B(6),B(7),B(8),B(9)
1350 B(1)=B(1)+B0/10
1360 PRINT 'ROW 2'
1370 INPUT B(10),B(14),B(16),B(17),B(18),B(19),B(20)
1380 PRINT 'ROW 3'
1390 INPUT B(21),B(22),B(23),B(24),B(25),B(27),B(28),B(29),B(30),B0
1400 B(30)=B(30)*100+B0
1410 IF X9=1 THEN 1310
1420 PRINT 'JENTER INDIRECT FIRE PARAMETERS'
1430 INPUT C,C0
1440 C(10)=C(10)*100+C0
1450 IF X9=1 THEN 1420
1460 RETURN
1470 REM-COMPUTE RATE OF ADVANCE AND FORCE RATIO ****
1480 IF B(3)=7 THEN 2080
1490 RESTORE 1510
1500 READ F0
1510 DATA 1,1,1,1,1,1,1,1,1,1
1520 DATA 1,1,1,1,1,1,1,1,1,1
1530 DATA 1,1,1,1,1,1,1,1,1,1
1540 DATA 1,1,1,1,1,1,1,1,1,1
1550 READ C1
1560 DATA 1,1
1570 READ C2
1580 DATA 1,1
1590 OPEN 'ADVRATE';2,'R',Z$
1600 REM-CALCULATE BLUE FIREPOWER SCORE
1610 FOR I=1 TO 10
1620 F2=F2+M(2,I)*F0(1+B(2),I)
1630 NEXT I
1640 F3=C(8)*8*C1(1+B(2))+C(2)*0.86*100+C(3)*100
1650 REM-CALCULATE RED FIREPOWER SCORE
1660 FOR I=1 TO 10
1670 B0=1
```

```
1680 IF I<>7 THEN 1700
1690 B0=B(30)-INT(B(30))
1700 F4=F4+M(4,I)*F0(3+B(2),I)*B0
1710 NEXT I
1720 F5=C(9)*8+C2(1+B(2))+C(6)*1.2*100+C(7)*100
1730 REM-CALCULATE A/D FIREPOWER RATIO
1740 B(13)=(F2+F3)*W1(1+B(2),B(3))/((F4+F5)*W1(2-B(2),B(3)))
1750 B(15)=F2*W1(1+B(2),B(3))/F4*W1(2-B(2),B(3))
1760 IF B(2)=0 THEN 1790
1770 B(13)=1/B(13)
1780 B(15)=1/B(15)
1790 REM-CALCULATE ADVANCE RATE
1800 IF B(13)<1 AND B(13)>0.8 AND (B(3)=2 OR B(3)=3) THEN 1820
1810 GO TO 1840
1820 F=1
1830 GO TO 1950
1840 IF B(13)<1 THEN 1860
1850 GO TO 1900
1860 A0=0
1870 A9=1
1880 A1=0
1890 GO TO 2050
1900 IF B(13)>8 THEN 1920
1910 GO TO 1940
1920 F=8
1930 GO TO 1950
1940 F=INT(B(13)+0.5)
1950 A9=F+1
1960 IF B(6)=0 THEN 1980
1970 F=F+8
1980 A1=1+8*(B(3)-1)+B(7)+2*(B(5-B(2))-1)
1990 ON EOF (2) THEN 2010
2000 READ #2,A1:A
2010 A0=A(F)
2020 IF B(8)=1 AND (B(3)<=3 OR B(3)=6) THEN 2040
2030 GO TO 2050
2040 A0=A0*0.75
2050 B(12)=A0
2060 B(11)=B(12)*B(14)
2070 CLOSE 2
2080 RETURN
2090 REM-COMPUTE MINEFIELD ATTRITION     ****
2100 IF B(21)=0 OR B(24)=0 OR B(25)=0 OR B(22)=0 OR B(3)=7 THEN 2250
2110 M0=B(24)*B(23)/B(22)
2120 01=0
2130 FOR I=1 TO 10
2140 01(I)=M(4-B(2)*2,I)*M0*B(25)*M9(1+B(2)*1,I)
2150 M(4-B(2)*2,I)=M(4-B(2)*2,I)-01(I)
2160 NEXT I
2170 IF B(2)=1 THEN 2220
2180 FOR I=1 TO 10
2190 V1(5,I)=V1(5,I)+01(I)
2200 NEXT I
```

```
2210 GO TO 2250
2220 FOR I=1 TO 10
2230 V2(5,I)=V2(5,I)+01(I)
2240 NEXT I
2250 RETURN
2260 REM-ATTACK HELICOPTER     ****
2270 IF B(3)=0 OR (C(2)=0 AND C(6)=0) THEN 2730
2280 OPEN 'MILWORTH';3,'R',Z$
2290 ON EOF (3) THEN 2310
2300 READ #3,3+2*B(27)+B(2):W
2310 CLOSE 3
2320 OPEN 'SSKP';3,'R',Z$
2330 ON EOF (3) THEN 2350
2340 READ #3,13:S
2350 CLOSE 3
2360 REM-INITIALIZE
2370 01=0
2380 02=0
2390 T=0
2400 T0=0
2410 T9=0
2420 REM-CALCULATE # OF TARGETS AND TARGET WORTH
2430 FOR I=1 TO 10
2440 IF M(4,I)=0 THEN 2470
2450 T(2,I)=M(4,I)*Q(2,I)*0.8*B(18)
2460 T9=T9+T(2,I)*W(2,I)
2470 IF M(2,I)=0 THEN 2500
2480 T(1,I)=M(2,I)*Q(1,I)*0.5*B(17)
2490 T0=T0+T(1,I)*W(1,I)
2500 NEXT I
2510 REM-COMPUTE LOSSES
2520 FOR I=1 TO 10
2530 IF C(2)=0 OR T(2,I)=0 OR T9=0 THEN 2590
2540 R=0
2550 R=C(2)*16*0.81*T(2,I)*W(2,I)/T9
2560 S0=S(1,I)
2570 IF R=0 OR S0>T(2,I) THEN 2590
2580 01(I)=T(2,I)*(1-(1-S0/T(2,I))^R)
2590 IF C(6)=0 OR T(1,I)=0 OR T0=0 THEN 2650
2600 R=0
2610 R=C(6)*6*0.81*T(1,I)*W(1,I)/T0
2620 S0=S(2,I)
2630 IF R=0 OR S0>T(1,I) THEN 2650
2640 02(I)=T(1,I)*(1-(1-S0/T(1,I))^R)
2650 NEXT I
2660 REM-UPDATE LOSSES
2670 FOR I=1 TO 10
2680 V1(4,I)=V1(4,I)+01(I)
2690 V2(4,I)=V2(4,I)+02(I)
2700 M(4,I)=M(4,I)-01(I)
2710 M(2,I)=M(2,I)-02(I)
2720 NEXT I
2730 RETURN
```

```
2740 REM-ERROR CHECK 1
2750 X9=0
2760 FOR I=1 TO 9 STEP 2
2770 IF O(1,I)>41 OR O(1,I)<0 OR O(2,I)<41 OR O(2,I)>119 THEN 2790
2780 GO TO 2810
2790 X9=1
2800 PRINT 'UNIT ID ERROR IN UNIT ';I
2810 K=I+1
2820 IF O(1,K)<0 OR O(1,K)>1 OR O(2,K)<0 OR O(2,K)>1 THEN 2840
2830 GO TO 2860
2840 X9=1
2850 PRINT 'ERROR IN FRACTION AVAILABLE FOR UNIT ';I
2860 IF X9=0 THEN 2880
2870 INPUT Z9
2880 RETURN
```

4. Ground Combat Program (Part 2). The second part of the ground combat program is called by part one of the program and, as such, is transparent to the user. This program considers direct fire attrition, artillery attrition, allows the input of air losses, and updates the required history files. Variables and data used in part one of the program are not repeated in the following documentation.

a. Variable Listing.

B	Sector battle parameters (array)
C	Indirect fire parameters (array)
E	Tgt element value for indirect fire assessment
F	File pointer for expected completed firings (ECF)
F1	Blue ECF table
F2	Red ECF table
F9	Dismounted infantry firepower ratio
G	Attacker defender dismounted infantry loss rates
H	Suppression table
H1	Blue direct fire suppression value
H2	Red direct fire suppression value
H4	Firepower score pointer for suppression calculation
K	Intermediate infantry kill value
K2,K3	Intermediate vehicle loss values
K4,K5	Dismounted infantry fractional casualty
L	Target exposure table
M	Original/surviving equipment matrix
M1,M2	Dummy infantry variables.
M3,M4	Intermediate infantry loss values
N	Unit status file (see App A)
O	Sector composition by unit and fraction
O1	Blue losses by system
O2	Red losses by system
R	Number of rounds fired
R0	Direct fire ADA/artillery fraction
S	SSKP table values
S0	Final SSKP for kill computation
S3	Vehicle specific suppression multiplier
T	Number of targets available
T0,T9	Fire distribution factor weighting values
V1,V2	KV matrices
X1, X2	KV matrices

b. File Structures (all on drive #0).

Name	Type	# Rec/Length	Remarks
UNITFILE	Random	120/340	Unit status (see App A)
SECTDATA	Sequential	na/2000	Sector input data
SSKP	Random	13/910	SSKP for Red/Blue weapons
ECFRED	Random	192/91	Expected completed firings (ECF) for Red firing at Blue.
ECFBLUE	Random	192/91	ECF for Blue firing at Red.
SUPPRESS	Random	6/82	Attacker/Defender suppression values.
MILWORTH	Random	13/185	Target values for attrition assessments.
CIDATA	Random	2/600	KV matrices used for history file.

c. Data Requirements.

Data	Location	Remarks
Target element composition for indirect fire assessment	Array E	As listed
Target availability factors for direct fire combat	Array L	As listed
Vehicle specific suppression factors	Array S3	As listed
Target value of direct and indirect fire targets	MILWORTH	Derived from JIFFY III unclassified data
Single shot kill probabilities and fractional damage tables	SSKP	See paragraph 3
Expected completed firings for systems 1-10	ECFRED and ECFBLUE	Classified, derived from JIFFY III data and categorized by weapon, visibility, terrain, and light conditions.
Suppression factors	SUPPRESS	Unclassified JIFFY III data.

```
100 REM-'F1A' IS THE 2ND PART OF THE DAME ATTRITION PROGRAM
110 INIT
120 DIM N(34),V1(5,10),Y$(1),O2(10),X1(6,10),X2(6,10)
130 DIM B(30),M(4,10),H(9),F1(10),F2(10),E(4,10),S(10,10)
140 DIM O1(10),O(2,10),T(2,10),G(2),W(2,10)
150 DIM C(10),V2(5,10),Q(2,10),L(4,10),S3(2,10)
160 OPEN 'UNITFILE';1,'F',Z$
170 OPEN 'SECTDATA';2,'R',Z$
180 ON EOF (2) THEN 210
190 READ #2:B,C,V1,V2,M,O,Q
200 PRINT C,B
210 CLOSE 2
220 REM-INITIALIZE
230 GOSUB 430
240 REM-COMPUTE DIRECT FIRE ATTRITION
250 GOSUB 660
260 REM-COMPUTE ARTILLERY ATTRITION
270 GOSUB 2110
280 REM-INSERT AIR LOSSES
290 GOSUB 2960
300 IF Z0=4 THEN 330
310 REM-UPDATE FILE AND PRINT SECTOR STATS
320 GOSUB 3310
330 REM-CLOSE OUT PROGRAM
340 CLOSE
350 PRINT 'LGMORE SECTOR BATTLES?  (Y OR N)'
360 INPUT Y$
370 IF Y$<>'Y' AND Y$<>'N' THEN 350
380 IF Y$='N' THEN 410
390 OLD 'F1'
400 GO TO 420
410 OLD 'DAME'
420 END
430 REM-INITIALIZE     ****
440 O1=0
450 O2=0
460 RESTORE 480
470 READ E
480 DATA 7,7,7,7,35,5,8,3,4,5
490 DATA 7,7,7,7,35,5,8,3,4,5
500 DATA 10,10,10,10,30,5,6,4,4,5
510 DATA 10,10,10,10,30,5,6,4,4,5
520 T=0
530 RESTORE 550
540 READ L
550 DATA 1,1,1,1,1,0.4,0.2,0.3,0.2,0.2
560 DATA 1,1,1,1,1,0.6,0.7,0.7,0.2,0.2
570 DATA 1,1,1,1,1,0.6,0.3,0.4,0.3,0.3
580 DATA 0.9,0.9,0.9,0.9,0.9,0.7,0.7,0.7,0.7,0.7
590 RESTORE 610
600 READ S3
610 DATA 1,2.86,2.86,2.86,2.86,0,3.5,3.5,0,0
```

```
620 DATA 1,2.86,2.86,2.86,2.86,0,3.5,3.5,0,0
630 T9=0
640 T0=0
650 RETURN
660 REM-DIRECT FIRE    ****
670 IF B(3)=7 THEN 2100
680 OPEN 'SSKP';2,'R',Z$
690 OPEN 'ECFRED';3,'R',Z$
700 OPEN 'ECFBLUE';4,'R',Z$
710 OPEN 'SUPPRESS';5,'R',Z$
720 OPEN 'MILWORTH';6,'R',Z$
730 ON EOF (6) THEN 780
740 IF B(27)=2 THEN 770
750 READ #6,1+B(2):W
760 GO TO 780
770 READ #6,3+B(2):W
780 CLOSE 6
790 REM-READ SUPPRESSION
800 ON EOF (5) THEN 850
810 READ #5,B(3):H
820 IF B(13)<8 THEN 850
830 H4=9
840 GO TO 860
850 H4=INT(B(13))+1
860 IF B(2)=1 THEN 900
870 H1=INT(H(H4))/100
880 H2=H(H4)-INT(H(H4))
890 GO TO 920
900 H1=H(H4)-INT(H(H4))
910 H2=INT(H(H4))/100
920 CLOSE 5
930 REM-INITIALIZE
940 O1=0
950 O2=0
960 M1=M(2,5)
970 M2=M(4,5)
980 M(2,5)=M(2,5)/10
990 M(4,5)=M(4,5)/33
1000 REM-BEGIN ATTRITION BY RANGE BANDS
1010 FOR I=B(8) TO B(16) STEP -1
1020 T=0
1030 R=0
1040 T0=0
1050 T9=0
1060 F=96*B(7)+(I-1)*16+(B(5)-1)*4+B(28)
1070 ON EOF (3) THEN 1090
1080 READ #3,F:F2
1090 F=96*B(7)+(I-1)*16+(B(4)-1)*4+B(28)
1100 ON EOF (4) THEN 1120
1110 READ #4,F:F1
1120 REM-CALCULATE #TARGETS AND TARGET VALUE
1130 FOR J=1 TO 10
1140 IF M(2,J)=0 THEN 1210
```

```
1150 T(1,J)=M(2,J)*B(17)*Q(1,J)*0.8*L(B(27),J)
1160 IF J<>8 THEN 1200
1170 T(1,J)=M(2,J)*B(17)*Q(1,J)*B(29)/100*0.8*L(B(27),J)
1180 T0=T0+T(J,1)*W(J,1)*B(29)/100
1190 GO TO 1210
1200 T0=T0+T(1,J)*W(1,J)
1210 IF M(4,J)=0 THEN 1320
1220 T(2,J)=M(4,J)*B(18)*Q(2,J)*0.8*L(2+B(27),J)
1230 IF J=8 THEN 1270
1240 IF J=8 THEN 1300
1250 T9=T9+T(2,J)*W(2,J)
1260 GO TO 1320
1270 T(2,J)=M(4,J)*B(18)*Q(2,J)*B(30)/100*0.8*L(2+B(27),J)
1280 T9=T9+T(2,J)*W(2,J)*B(30)/100
1290 GO TO 1320
1300 T(2,J)=M(4,J)*B(18)*Q(2,J)*(B(30)-INT(B(30)))*0.8
1310 T9=T9+T(2,J)*W(2,J)*(B(30)-INT(B(30)))
1320 NEXT J
1330 REM-CALCULATE RED LOSSES
1340 ON EOF (2) THEN 1360
1350 READ #2,2*I-1:S
1360 FOR J=1 TO 10
1370 IF T(2,J)=0 THEN 1530
1380 K2=1
1390 FOR K=1 TO 10
1400 IF M(2,K)=0 OR S(K,J)=0 OR F1(K)=0 THEN 1510
1410 R0=1
1420 IF K<>8 THEN 1440
1430 R0=B(29)
1440 R=0
1450 R=M(2,K)*O(1,K)*F1(K)*(1-H1*S3(1,K))*0.9*B(17)*(1-B(19))
1460 R=R*T(2,J)*W(2,J)/T9*R0
1470 S0=((2-B(2))*S(K,J)/100+(1+B(2))*(S(K,J)-INT(S(K,J))))/3
1480 IF R=0 OR S0>T(2,J) THEN 1510
1490 K3=(1-S0/T(2,J))^R
1500 K2=K2*K3
1510 NEXT K
1520 O2(J)=T(2,J)*(1-K2)
1530 NEXT J
1540 REM-CALCULATE BLUE LOSSES
1550 ON EOF (2) THEN 1560
1560 READ #2,2*I:S
1570 FOR J=1 TO 10
1580 IF T(1,J)=0 THEN 1770
1590 K2=1
1600 FOR K=1 TO 10
1610 IF M(4,K)=0 OR S(K,J)=0 OR F2(K)=0 THEN 1750
1620 R0=1
1630 IF K<>7 THEN 1660
1640 R0=B(30)-INT(B(30))
1650 GO TO 1680
1660 IF K<>8 THEN 1680
1670 R0=INT(B(30))/100
```

```
1680 R=0
1690 R=M(4,K)*O(2,K)*F2(K)*(1-H2*S3(2,K))*0.9*B(18)*(1-B(20))
1700 R=R*T(1,J)*W(1,J)/TO*RO
1710 SO=((1+B(2))*S(K,J)/100+(2-B(2))*(S(K,J)-INT(S(K,J))))/3
1720 IF R=0 OR SO>T(1,J) THEN 1750
1730 K3=(1-SO/T(1,J))^R
1740 K2=K2*K3
1750 NEXT K
1760 O1(J)=T(1,J)*(1-K2)
1770 NEXT J
1780 NEXT I
1790 REM-UPDATE LOSSES
1800 FOR I=1 TO 10
1810 IF I=5 THEN 1870
1820 M(2,I)=M(2,I)-O1(I)
1830 M(4,I)=M(4,I)-O2(I)
1840 V1(1,I)=V1(1,I)+O2(I)
1850 V2(1,I)=V2(1,I)+O1(I)
1860 GO TO 1990
1870 M3=O1(I)*2
1880 M4=O2(I)*2
1890 IF M3>M1 THEN 1910
1900 GO TO 1920
1910 M3=M1
1920 IF M4>M2 THEN 1940
1930 GO TO 1950
1940 M4=M2
1950 M(2,I)=M1-M3
1960 M(4,I)=M2-M4
1970 V1(1,I)=V1(1,I)+M4
1980 V2(1,I)=V2(I,I)+M3
1990 NEXT I
2000 CLOSE 2
2010 CLOSE 3
2020 CLOSE 4
2030 IF B(6)=0 OR (B(10)=1 AND B(16)=1) THEN 2050
2040 GO TO 2100
2050 REM-DISMOUNTED INFANTRY CLOSE COMBAT
2060 REM    CODE IN THIS SUBROUTINE CONTAINS CLASSIFIED
2070 REM    EQUATIONS.  THIS SUBROUTINE IS AVAILABLE TO
2080 REM    QUALIFIED AGENCIES AND CAN BE OBTAINED BY
2090 REM    CONTACTING THE AUTHORS.
2100 RETURN
2110 REM-COMPUTE ARTILLERY ATTRITION     ****
2120 IF C(1)=0 AND C(5)=0 AND C(4)=0 THEN 2950
2130 GOSUB 430
2140 OPEN 'MILWORTH';2,'R',Z$
2150 ON EOF (2) THEN 2170
2160 READ #2,7+2*B(27)+B(2):W
2170 CLOSE 2
2180 REM-COMPUTE AREA TARGETS
2190 FOR I=1 TO 10
2200 IF M(2,I)=0 THEN 2240
```

```
2210 T(1,I)=M(2,I)*Q(1,I)/E(1+B(2),I)*0.8
2220 IF I=7 THEN 2240
2230 T0=T0+T(1,I)*W(1,I)
2240 IF M(4,I)=0 THEN 2280
2250 T(2,I)=M(4,I)*Q(2,I)/E(3+B(2),I)*0.7
2260 IF I=7 THEN 2280
2270 T9=T9+T(2,I)*W(2,I)
2280 NEXT I
2290 REM-COMPUTE LOSSES
2300 D1=INT(C(10))/100
2310 D2=1-D1
2320 D3=C(10)-INT(C(10))
2330 D4=1-D3
2340 OPEN "SSKP";3,"R",Z$
2350 ON EOF (3) THEN 2370
2360 READ #3,14:S
2370 CLOSE 3
2380 FOR I=1 TO 10
2390 R1=C(1)*D1
2400 R2=C(5)*D3
2410 IF I<>7 THEN 2450
2420 R1=C(1)*D2
2430 R2=C(5)*D4
2440 REM-RED LOSSES
2450 IF C(1)=0 OR T(2,I)=0 OR S(1+B(2),I)>T(2,I) OR T9=0 THEN 2520
2460 IF I<>7 THEN 2490
2470 R=R1
2480 GO TO 2500
2490 R=R1*T(2,I)*W(2,I)/T9
2500 O1(I)=T(2,I)*E(1+B(2),I)*(1-(1-S(1+B(2),I)/T(2,I))^R)
2510 REM-BLUE LOSSES
2520 IF C(5)=0 OR T(1,I)=0 OR S(3+B(2),I)>T(1,I) OR T0=0 THEN 2580
2530 IF I<>7 THEN 2560
2540 R=R2
2550 GO TO 2570
2560 R=R2*T(1,I)*W(1,I)/T0
2570 O2(I)=T(1,I)*E(3+B(2),I)*(1-(1-S(3+B(2),I)/T(1,I))^R)
2580 NEXT I
2590 REM-UPDATE LOSSES
2600 FOR I=1 TO 10
2610 V1(2,I)=V1(2,I)+O1(I)
2620 V2(2,I)=V2(2,I)+O2(I)
2630 M(4,I)=M(4,I)-O1(I)
2640 M(2,I)=M(2,I)-O2(I)
2650 NEXT I
2660 REM-CLGP KILLS BY BLUE
2670 IF C(4)=0 THEN 2950
2680 OPEN "MILWORTH";3,"R",Z$
2690 ON EOF (3) THEN 2710
2700 READ #3,13:W
2710 CLOSE 3
2720 T=0
2730 T9=0
```

```
2740 R=C(4)
2750 O1=0
2760 REM-COMPUTE #TARGETS AND TARGET VALUE
2770 FOR I=1 TO 10
2780 IF M(4,I)=0 THEN 2810
2790 T(2,I)=0.6*M(4,I)*O(2,I)
2800 T9=T9+T(2,I)*W(1+B(2),I)
2810 NEXT I
2820 REM-CLGP KILLS
2830 IF T9=0 THEN 2900
2840 FOR I=1 TO 10
2850 IF T(2,I)=0 OR S(5,I)=0 OR S(5,I)>T(2,I) THEN 2890
2860 R=0
2870 R=C(4)*2*W(1+B(2),I)*T(2,I)/T9*0.8*0.8
2880 O1(I)=T(2,I)*(1-(1-S(5,I)/T(2,I))^R)
2890 NEXT I
2900 REM-UPDATE LOSSES
2910 FOR I=1 TO 10
2920 V1(2,I)=V1(2,I)+O1(I)
2930 M(4,I)=M(4,I)-O1(I)
2940 NEXT I
2950 RETURN
2960 REM-INSERT AIR LOSSES    ****
2970 REM-UPDATE INF LOSSES IN CARRIERS
2980 GOSUB 4080
2990 PRINT 'LBLUE KILLER-RED VICTIM'
3000 PRINT USING 3010:V1
3010 IMAGE 5[10[4D.1D,1X],/]
3020 PRINT 'RED KILLER-BLUE VICTIM'
3030 PRINT USING 3010:V2
3040 PRINT 'BLUE/RED FORCES'
3050 PRINT USING 3060:M
3060 IMAGE 4[10[4D.1D,1X],/]
3070 PRINT 'INSERT LOSSES?  (1-BLUE   2-RED   3-NO MORE    4-ABORT)'
3080 INPUT Z0
3090 IF Z0<>1 AND Z0<>2 AND Z0<>3 AND Z0<>4 THEN 3070
3100 O1=0
3110 GO TO Z0 OF 3120,3210,3300,3300
3120 PRINT 'JENTER LINE NUMBER (1-5)'
3130 INPUT J
3140 PRINT 'ENTER BLUE LOSSES (1-10)'
3150 INPUT O1
3160 FOR I=1 TO 10
3170 V2(J,I)=V2(J,I)+O1(I)
3180 M(2,I)=M(2,I)-O1(I)
3190 NEXT I
3200 GO TO 2990
3210 PRINT 'JENTER LINE NUMBER (1-5)'
3220 INPUT J
3230 PRINT 'ENTER RED LOSSES (1-10)'
3240 INPUT O1
3250 FOR I=1 TO 10
3260 V1(J,I)=V1(J,I)+O1(I)
```

```
3270 M(4,I)=M(4,I)-O1(I)
3280 NEXT I
3290 GO TO 2990
3300 RETURN
3310 REM UPDATE AND PRINT RESULTS
3320 PRINT @42:'LSECTOR ';B(1);' RESULTS '
3330 PRINT @42:'JSECTOR PARAMETERSJ'
3340 PRINT @42: USING 3350:B
3350 IMAGE 3[10[4D.2D,2X],/]
3360 PRINT @42:'JINDIRECT FIRE PARAMETERS'
3370 PRINT @42: USING 3380:C
3380 IMAGE 10[3D.1D,2X]
3390 REM-PRINT SPECIFIC RESULTS
3400 GOSUB 4450
3410 PRINT @42:'JUNITS'
3420 PRINT @42: USING 3430:O
3430 IMAGE 2[10[3D.2D,2X],/]
3440 PRINT @42:'BLUE/RED LOSSES'
3450 PRINT @42: USING 3460:M
3460 IMAGE 4[10[4D.1D,1X],/]
3470 PRINT @42:'BLUE KILLER-RED VICTIM'
3480 PRINT @42: USING 3490:V1
3490 IMAGE 5[10[4D.1D,1X],/]
3500 PRINT @42:'RED KILLER-BLUE VICTIM'
3510 PRINT @42: USING 3490:V2
3520 REM-APPORTION BLUE LOSSES AND WRITE TO FILE
3530 O1=0
3540 FOR I=1 TO 10
3550 O1(I)=M(1,I)-M(2,I)
3560 NEXT I
3570 FOR I=1 TO 9 STEP 2
3580 IF O(1,I)=0 THEN 3690
3590 ON EOF (1) THEN 3610
3600 READ #1,O(1,I):N
3610 FOR J=1 TO 10
3620 IF M(1,J)=0 THEN 3660
3630 N(J)=N(J)-O1(J)*O(1,I+1)*N(J)/M(1,J)
3640 IF N(J)>0 THEN 3660
3650 N(J)=0
3660 NEXT J
3670 ON EOF (1) THEN 3690
3680 WRITE #1,O(1,I):N
3690 NEXT I
3700 REM-APPORTION RED LOSSES AND WRITE TO UNIT FILE
3710 O1=0
3720 FOR I=1 TO 10
3730 O1(I)=M(3,I)-M(4,I)
3740 NEXT I
3750 FOR I=1 TO 9 STEP 2
3760 IF O(2,I)=0 THEN 3870
3770 ON EOF (1) THEN 3790
3780 READ #1,O(2,I):N
3790 FOR J=1 TO 10
```

```
3800 IF M(3,J)=0 THEN 3840
3810 N(J)=N(J)-O1(J)*O(2,I+1)*N(J)/M(3,J)
3820 IF N(J)>0 THEN 3840
3830 N(J)=0
3840 NEXT J
3850 ON EOF (1) THEN 3870
3860 WRITE #1,O(2,I):N
3870 NEXT I
3880 OPEN 'CIDATA';4,'F',Z$
3890 ON EOF (4) THEN 3920
3900 READ #4,1:X1
3910 READ #4,2:X2
3920 FOR I=1 TO 5
3930 FOR J=1 TO 10
3940 X1(I,J)=X1(I,J)+V1(I,J)
3950 X2(I,J)=X2(I,J)+V2(I,J)
3960 NEXT J
3970 NEXT I
3980 ON EOF (4) THEN 4010
3990 WRITE #4,1:X1
4000 WRITE #4,2:X2
4010 CLOSE 4
4020 N=0
4030 N(1)=INT(B(1))
4040 ON EOF (1) THEN 4060
4050 WRITE #1,120:N
4060 CLOSE 1
4070 RETURN
4080 REM-KILLS OF INF IN VEH
4090 FOR I=1 TO 10
4100 IF M(4,I)>0 THEN 4120
4110 M(4,I)=0
4120 IF M(2,I)>0 THEN 4140
4130 M(2,I)=0
4140 NEXT I
4150 FOR I=1 TO 5
4160 GOSUB 4200
4170 GOSUB 4290
4180 NEXT I
4190 RETURN
4200 REM-BLUE INF KILLS IN VEH
4210 K=0
4220 K=V2(I,2)*3
4230 KO=M(2,5)
4240 IF K<KO THEN 4260
4250 K=KO
4260 V2(I,5)=V2(I,5)+K
4270 M(2,5)=M(2,5)-K
4280 RETURN
4290 REM-RED INF KILLS IN VEH
4300 K=0
4310 K=V1(I,2)*4
4320 KO=M(4,5)
```

```
4330 IF K<KO THEN 4350
4340 K=KO
4350 V1(I,5)=V1(I,5)+K
4360 M(4,5)=M(4,5)-K
4370 K=0
4380 K=V1(I,3)*4
4390 KO=M(4,5)
4400 IF K<KO THEN 4420
4410 K=KO
4420 V1(I,5)=V1(I,5)+K
4430 M(4,5)=M(4,5)-K
4440 RETURN
4450 REM-PRINT ADV RATE
4460 PRINT @42: USING 4470:"ATKR/DEF FORCE RATIO:";B(13);" : 1"
4470 IMAGE 1L,21A,1X,2D.1D,4A
4480 PRINT @42: USING 4490:"ADVANCE RATE (KM/HR):";B(12)
4490 IMAGE 21A,2X,2D.1D
4500 PRINT @42: USING 4510:"TOTAL ADVANCE (KM):";B(11)
4510 IMAGE 19A,1X,3D.1D
4520 RETURN
```

5. Data Entry Program. This program (Program 2 on the DAME menu) manipulates the unit status file (UNITFILE - see App A) and allows the operator to initialize and update units played in DAME. This program is used in game initialization and in each game turn to update changes in unit status.

a. Variable listing.

A	Vehicle ammunition capacity
F	Vehicle fuel capacity
M$	Unit name
N	Unit status variable (see App A)
N1,N2	Intermediate variables used for error check
S	System firepower score
U	Equipment level and unit effectiveness score
X9	Status flag

b. File Structures Used (all on Drive #0).

Name	Type	# Rec/Length	Remarks
UNITFILE	Random	120/340	Unit status (see App A)
TEMPFILE	Random	120/340	Backup unit status file.
NAMEFILE	Random	120/15	Unit names
TOEFILE	Random	120/110	Unit TOE file

c. Data Requirements.

Data	Location	Remarks
System firepower scores	Array S	Derived from JIFFY data (classified)
System fuel capacity	Array A	As listed
System ammunition capacity	Array F	As listed

```
100 REM- 'P2' IS THE DAME PROGRAM TO CONTROL UNIT FILE ENTRY OPERATIONS
110 INIT
120 DIM N(34),M$(8),A(2,11),F(2,11),S(2,11),U(12)
130 OPEN 'NAMEFILE';2,'F',Z$
140 IMAGE 6[5[6D.6D,1X],/],4[6D.6D,1X]
150 OPEN 'UNITFILE';1,'F',Z$
160 OPEN 'TOEFILE';3,'F',Z$
170 REM-INITIALIZE
180 GOSUB 430
190 PRINT 'L              FILE OPERATION PROGRAM'
200 PRINT 'JENTER NUMBER OF DESIRED ACTION--'
210 PRINT 'J     1 -- RETURN TO MASTER MENU'
220 PRINT '     2 -- ADJUST EQUIPMENT LEVEL ONLY'
230 PRINT '     3 -- ENTER NAME ONLY'
240 PRINT '     4 -- ADJUST CI PARAMETERS'
250 PRINT '     5 -- ENTER ENTIRE FILE FOR A UNIT'
260 PRINT '     6 -- DISPLAY UNIT STATUS'
270 PRINT '     7 -- CHANGE MOPP STATUS'
280 PRINT '     8 -- CHANGE UNIT STATUS FLAG'
290 PRINT '     9 -- CREATE BACKUP UNIT FILE'
300 PRINT '    10 -- CHANGE SINGLE VALUE'
310 PRINT '   '
320 INPUT I
330 B9=I
340 IF I>10 OR I<1 THEN 190
350 GOSUB I OF 570,620,800,920,2000,2590,2980,3300,3610,3880
360 GO TO 190
370 CLOSE 1
380 CLOSE 2
390 CLOSE 3
400 OLD 'DAME'
410 END
420 IMAGE 3D,2X,6A,3X,4[3D.1D],1X,4D.1D,5[1X,3D.1D]
430 REM-INITIALIZE
440 RESTORE 460
450 READ A
460 DATA 2.33,1.22,2.02,0.916,0.02,0,1.98,3.02,0,0,9.01
470 DATA 1.85,1.4,0.2,0.2,0.02,0.14,2.63,4.6,0,0,10.3
480 RESTORE 500
490 READ F
500 DATA 500,175,175,95,0,105,125,248,78,80,325
510 DATA 265,122,76.6,76.6,0,58.1,76.6,137.4,95,66,225
520 RESTORE 540
530 READ S
540 DATA 1,1,1,1,1,1,1,1,1,1,1
550 DATA 1,1,1,1,1,1,1,1,1,1,1
560 RETURN
570 REM-RETURN TO MASTER MENU
580 CLOSE 1
590 CLOSE 2
600 OLD 'DAME'
610 RETURN
```

```
620 REM-ADJUST EQUIPMENT LEVEL
630 PRINT 'LEQUIPMENT ENTRY FOR SYSTEMS 1-10'
640 PRINT USING 650:'ENTER UNIT NUMBER (1-119, 999=STOP)-- '
650 IMAGE 38A,S
660 INPUT I
670 IF I=999 THEN 790
680 IF I>119 OR I<1 THEN 640
690 ON EOF (1) THEN 710
700 READ #1,I:N
710 ON EOF (2) THEN 730
720 READ #2,I:M$
730 PRI USI 420:I,M$,N(1),N(2),N(3),N(4),N(5),N(6),N(7),N(8),N(9),N(10)
740 PRINT USING 750:'EQPT='
750 IMAGE 5A,S
760 INPUT N(1),N(2),N(3),N(4),N(5),N(6),N(7),N(8),N(9),N(10)
770 GOSUB 2240
780 GO TO 640
790 RETURN
800 REM-INPUT UNIT NAME
810 PRINT 'LENTER UNIT NAMES (8 CHAR MAX, 999=STOP)'
820 PRINT USING 830:'ENTER UNIT #, NAME -- '
830 IMAGE 22A,S
840 INPUT I,A$
850 IF I<1 AND I>119 THEN 820
860 IF I=999 THEN 910
870 M$=SEG(A$,2,8)
880 ON EOF (2) THEN 900
890 WRITE #2,I:M$
900 GO TO 820
910 RETURN
920 REM-ADJUST UNIT PARAMETERS
930 PRINT 'LUNIT PARAMETER ADJUSTMENT'
940 PRINT 'ENTER UNIT #  (999=STOP)'
950 INPUT I
960 IF I=999 THEN 1990
970 IF I<1 OR I>119 THEN 920
980 ON EOF (1) THEN 1000
990 READ #1,I:N
1000 PRINT 'DESIRED CHANGE:   1-LOG                    6-INT+STA'
1010 PRINT '                  2-INTEL                  7-LOG+INT+STA'
1020 PRINT '                  3-STATE                  8-LOG+INT+STA+POL'
1030 PRINT '                  4-LOG+INT                9-FRA POL+ SP P/A'
1040 PRINT '                  5-LOG+STA                0-COMPLETE'
1050 INPUT J
1060 IF J=0 THEN 1080
1070 GO TO 1100
1080 GOSUB 2240
1090 GO TO 920
1100 GO TO J OF 1110,1150,1200,1240,1290,1330,1380,1430,1500
1110 PRINT 'JINPUT 4 VALUES'
1120 INPUT N(13),N(17),N(18),N(28)
1130 GOSUB 1540
1140 GO TO 1000
```

```
1150 PRINT 'JINPUT 3 VALUES'
1160 INPUT N1,N2,N(29)
1170 N(22)=N1+N2/10
1180 GOSUB 1540
1190 GO TO 1000
1200 PRINT 'JINPUT 2 VALUES'
1210 INPUT N(23),N(34)
1220 GOSUB 1540
1230 GO TO 1000
1240 PRINT 'JINPUT 7 VALUES'
1250 INPUT N(13),N(17),N(18),N(28),N1,N2,N(29)
1260 N(22)=N1+N2/10
1270 GOSUB 1540
1280 GO TO 1000
1290 PRINT 'JINPUT 6 VALUES'
1300 INPUT N(13),N(17),N(18),N(28),N(23),N(34)
1310 GOSUB 1540
1320 GO TO 1000
1330 PRINT 'JINPUT 5 VALUES'
1340 INPUT N1,N2,N(29),N(23),N(34)
1350 N(22)=N1+N2/10
1360 GOSUB 1540
1370 GO TO 1000
1380 PRINT 'JINPUT 9 VALUES'
1390 INPUT N(13),N(17),N(18),N(28),N1,N2,N(29),N(23),N(34)
1400 N(22)=N1+N2/10
1410 GOSUB 1540
1420 GO TO 1000
1430 PRINT 'JINPUT 10 VALUES'
1440 INPUT N(13),N(17),N(18),N(28),N1,N2,N(29),N(23),N(34),N(27)
1450 N(22)=N1+N2/10
1460 PRINT 'INPUT 2 VALUES'
1470 INPUT N(31),N(32)
1480 GOSUB 1540
1490 GO TO 1000
1500 PRINT 'JINPUT POL TRUCK FRACTION AND SPLY PT POL/AMMO'
1510 INPUT N(27),N(31),N(32)
1520 GOSUB 1540
1530 GO TO 1000
1540 REM-INPUT ERROR CHECK
1550 X9=0
1560 N1=INT(N(13))
1570 N2=(N(13)-N1)*10
1580 IF N1<0 OR N1>9 OR N2<0 OR N2>9 THEN 1600
1590 GO TO 1620
1600 PRINT 'MISSION ENTRY INCORRECT'
1610 X9=1
1620 IF N(15)>1 OR N(15)<0 THEN 1640
1630 GO TO 1660
1640 PRINT 'POL STATUS INCORRECT'
1650 X9=1
1660 IF N(16)>1 OR N(16)<0 THEN 1680
1670 GO TO 1700
```

```
1680 PRINT 'AMMO STATUS INCORRECT'
1690 X9=1
1700 N1=INT(N(22))
1710 N2=(N(22)-N1)*10
1720 IF N1<1 OR N1>5 OR N2<0 OR N2>4 THEN 1740
1730 GO TO 1760
1740 PRINT 'DETECTION ENTRY INCORRECT'
1750 X9=1
1760 IF N(23)<>1 AND N(23)<>2 THEN 1780
1770 GO TO 1800
1780 PRINT 'MOPP STATUS INCORRECT'
1790 X9=1
1800 N1=INT(N(24))
1810 N2=(N(24)-N1)*10
1820 IF N1<>1 AND N1<>2 OR N2<0 OR N2>9 THEN 1840
1830 GO TO 1860
1840 PRINT 'UNIT TYPE INCORRECT'
1850 X9=1
1860 IF N(27)>1 OR N(27)<0 THEN 1880
1870 GO TO 1900
1880 PRINT 'TANKER FRACTION INCORRECT'
1890 X9=1
1900 IF N(29)>1 OR N(29)<0 THEN 1920
1910 GO TO 1940
1920 PRINT 'SENSOR COVERAGE FRACTION INCORRECT'
1930 X9=1
1940 IF N(34)=0 OR N(34)=1 THEN 1970
1950 PRINT 'STATUS ENTRY INCORRECT'
1960 X9=1
1970 IF X9=0 THEN 1990
1980 INPUT Z1
1990 RETURN
2000 REM-ENTER ENTIRE UNIT FILE
2010 PRINT 'LUNIT FILE ENTRY (NAME+EQUIPMENT+PARAMETERS)'
2020 PRINT USING 2030:'ENTER UNIT NUMBER (1-119, 999=STOP)-- '
2030 IMAGE 38A,S
2040 INPUT I
2050 IF I=999 THEN 2580
2060 IF I>119 OR I<1 THEN 2020
2070 PRINT USING 2080:'ENTER UNIT NAME (8 CHAR)-- '
2080 IMAGE 27A,S
2090 INPUT M$
2100 N=0
2110 PRINT 'EQUIPMENT (1-10)-- '
2120 INPUT N(1),N(2),N(3),N(4),N(5),N(6),N(7),N(8),N(9),N(10)
2130 PRINT 'PARAMETERS (1-9) -- '
2140 INPUT N(13),N(15),N(16),N(22),N(23),N(24),M1,M2,N(27)
2150 PRINT 'PARAMETERS (11-12)'
2160 INPUT N(29),N(34)
2170 ON EOF (2) THEN 2170
2180 WRITE #2,I:M$
2190 REM-MAKE ERROR CHECK
2200 GOSUB 1540
```

```
2210 IF X9=1 THEN 2130
2220 GOSUB 2240
2230 GO TO 2020
2240 REM-CALCULATE COMBAT EFFECTIVENESS
2250 ON EOF (3) THEN 2270
2260 READ #3,I:U
2270 U0=0
2280 K=INT(N(24))
2290 IF K=0 THEN 2550
2300 FOR J=1 TO 10
2310 IF J=7 AND (N(24)=1.1 OR N(24)=2.1) THEN 2340
2320 U0=U0+N(J)*S(K,J)
2330 GO TO 2350
2340 U0=U0+N(J)*S(K,11)
2350 NEXT J
2360 N(11)=U0/U(11)
2370 REM-CALCULATE FUEL/AMMO ON HAND
2380 A0=0
2390 F0=0
2400 FOR J=1 TO 10
2410 IF J=7 AND (N(24)=1.1 OR N(24)=2.1) THEN 2450
2420 A0=A0+N(J)*A(K,J)*N(16)
2430 F0=F0+N(J)*F(K,J)*N(15)
2440 GO TO 2470
2450 A0=A0+N(J)*A(K,11)*N(16)
2460 F0=F0+N(J)*F(K,11)*N(15)
2470 NEXT J
2480 IF B9=5 THEN 2510
2490 M1=(N(25)-INT(N(25)))*1000000
2500 M2=(N(26)-INT(N(26)))*100000
2510 N(25)=INT(F0)+M1/1000000
2520 N(26)=INT(A0)+M2/100000
2530 REM-UPDATE N[30]
2540 N(30)=N(9)
2550 REM-WRITE TO FILE
2560 GOSUB 3690
2570 RETURN
2580 RETURN
2590 REM-DISPLAY UNIT STATUS
2600 PRINT 'LUNIT STATUS DISPLAY'
2610 V=42
2620 PRINT 'ENTER OUTPUT DESIRED:      1-ALL UNITS      2-SPECIFIC UNITS'
2630 INPUT Z5
2640 IF Z5<>1 AND Z5<>2 THEN 2620
2650 IF Z5=2 THEN 2710
2660 PRINT @42:'L  '
2670 FOR I=1 TO 119
2680 GOSUB 2780
2690 NEXT I
2700 GO TO 2970
2710 PRINT USING 2720:'UNIT #  (999=STOP)   '
2720 IMAGE 20A,S
2730 INPUT I
```

```
2740 IF I=999 THEN 2970
2750 IF I<1 OR I>119 THEN 2710
2760 GOSUB 2780
2770 GO TO 2710
2780 REM-PRINT SUBROUTINE
2790 ON EOF (1) THEN 2910
2800 READ #1,I:N
2810 ON EOF (2) THEN 2930
2820 READ #2,I:M$
2830 PRINT @42:"JUNIT # ";I;"     ";M$
2840 PRINT @42: USING 2850:N(1),N(2),N(3),N(4),N(5),N(6),N(7),N(8),N(9)
2850 IMAGE 9[4D.1D,1X],S
2860 PRINT @42: USING 2870:N(10),"11-20",N(11),N(12),N(13),N(14),N(15)
2870 IMAGE 4D.1D,/,6A,5[2D.2D,2X],    S
2880 PRINT @42: USING 2890:N(16),N(17),N(18),N(19),N(20)
2890 IMAGE 2D.2D,1X,4[6D,1X]
2900 PRINT @42: USING 2910:"21-26",N(21),N(22),N(23),N(24),N(25),N(26)
2910 IMAGE 7A,4[1D.1D,2X],2[6D.6D,2X]
2920 PRINT @42: USING 2930:"27-34",N(27),N(28),N(29),N(30),N(31),N(32)
2930 IMAGE 5A,4[3D.2D,2X],2[6D,2X],S
2940 PRINT @42: USING 2950:N(33),N(34)
2950 IMAGE 2[2X,3D.2D]
2960 RETURN
2970 RETURN
2980 REM-CHANGE MOPP STATUS
2990 PRINT "LCHANGE MOPP STATUS"
3000 PRINT "JMETHOD OF CHANGE:   1-ALL UNITS      2-SPECIFIC UNITS"
3010 INPUT Z5
3020 IF Z5<>1 AND Z5<>2 THEN 2990
3030 IF Z5=2 THEN 3150
3040 PRINT "JPOSSIBLE MOPP LEVELS ARE:  1-NO MOPP    2-MOPP 4"
3050 FOR I=1 TO 119
3060 ON EOF (1) THEN 3080
3070 READ #1,I:N
3080 PRINT USING 3090:"UNIT ";I;"  MOPP IS "
3090 IMAGE 5A,3D,10A,S
3100 INPUT J
3110 IF J<>1 AND J<>2 THEN 3080
3120 GOSUB 3250
3130 NEXT I
3140 GO TO 3290
3150 PRINT "JPOSSIBLE MOPP LEVELS ARE:   1-NO MOPP     2-MOPP 4"
3160 PRINT "ENTER UNIT #, MOPP    (999,999=STOP)"
3170 INPUT I,J
3180 IF I<1 AND I>119 THEN 3160
3190 IF I=999 THEN 3290
3200 IF J<>1 AND J<>2 THEN 3160
3210 ON EOF (1) THEN 3230
3220 READ #1,I:N
3230 GOSUB 3250
3240 GO TO 3150
3250 N(23)=J
3260 ON EOF (1) THEN 3280
```

```
3270 WRITE #1,I:N
3280 RETURN
3290 RETURN
3300 REM-CHANGE UNIT PLAYER FLAG
3310 PRINT 'LUPDATE UNIT STATUS FLAG'
3320 PRINT 'JSELECT OPTION:   1-ALL UNITS    2-SPECIFIC UNITS'
3330 INPUT J
3340 IF J<>1 AND J<>2 THEN 3300
3350 IF J=2 THEN 3460
3360 FOR I=1 TO 119
3370 ON EOF (1) THEN 3390
3380 READ #1,I:N
3390 PRINT USING 3400:'UNIT ';I;' ENTER STATUS (0 OR 1) '
3400 IMAGE 5A,3D,22A,2X,S
3410 INPUT J
3420 IF J<>1 AND J<>0 THEN 3390
3430 GOSUB 3560
3440 NEXT I
3450 GO TO 3600
3460 REM-SPECIFIC UNITS
3470 PRINT 'ENTER UNIT#, STATUS (0 OR 1)      (999,999=STOP)'
3480 INPUT I,J
3490 IF I=999 THEN 3600
3500 IF I>119 OR I<1 THEN 3470
3510 IF J<>0 AND J<>1 THEN 3470
3520 ON EOF (1) THEN 3540
3530 READ #1,I:N
3540 GOSUB 3560
3550 GO TO 3460
3560 N(34)=J
3570 ON EOF (1) THEN 3590
3580 WRITE #1,I:N
3590 RETURN
3600 RETURN
3610 REM-CREATE TEMPORARY FILE
3620 CLOSE 1
3630 KILL 'TEMPFILE'
3640 COPY 'UNITFILE',0 TO 'TEMPFILE',0
3650 PRINT 'TEMPORARY FILE CREATED AND FILLED'
3660 INPUT Z1
3670 OPEN 'UNITFILE';1,'F',Z$
3680 RETURN
3690 REM-WRITE N-FILE TO DISK
3700 N1=INT(N(13))
3710 IF N(24)=0 THEN 3840
3720 N2=(N(13)-N1)*10
3730 IF N(13)=0 THEN 3770
3740 IF N1=>5 AND N1<8 OR (N2=>5 AND N2<8) THEN 3790
3750 IF N1=>2 AND N1<5 OR (N2=>2 AND N2<5) THEN 3810
3760 IF N1=8 OR N1=9 OR N2=8 OR N2=9 THEN 3830
3770 N(21)=3
3780 GO TO 3840
3790 N(21)=1
```

```
3800 GO TO 3840
3810 N(21)=2
3820 GO TO 3840
3830 N(21)=4
3840 REM-PRINT TO N-FILE
3850 ON EOF (1) THEN 3870
3860 WRITE #1,I:N
3870 RETURN
3880 REM-CHANGE SINGLE VALUE
3890 PRINT 'LCHANGE SINGLE VALUES IN THE UNITFILE'
3900 PRINT 'JENTER UNIT NUMBER 1-119   (999=STOP)'
3910 INPUT I
3920 IF I=999 THEN 4040
3930 IF I<1 OR I>119 THEN 3880
3940 ON EOF (1) THEN 3960
3950 READ #1,I:N
3960 PRINT 'ENTER ITEM #,NEW VALUE      (999,999=STOP)'
3970 INPUT J,NO
3980 IF J=999 THEN 4020
3990 IF J<1 OR J>34 THEN 3960
4000 N(J)=NO
4010 GO TO 3960
4020 GOSUB 2240
4030 GO TO 3880
4040 RETURN
```

6. Chemical Attrition Program. This program (Program 3 of the DAME menu) calculates attrition from chemical munitions based on agent type firing unit, unit type and composition, and MOPP status.

a. Variable listing.

A(I)	Number of mission assessments of a particular mission against unit I. DIM (10).
A1,A2,A3	Input answer (1 = Yes, 2 = No).
A9(I,J)	Casualty fraction of element I with target radius J for assessing a unit in the attack profile. DIM (10,5). Character string RED or BLUE.
C(I)	Total chemical kills of element I for entire mission M1.
C9(I)	Total chemical kills of element I for entire DAME game or a Critical Incident.
D9 (I,J)	Casualty fraction of element I with target radius J for assessing a unit in the defend profile.
F(I)	Target fraction of unit I to be chemically assessed.
F1	Force type flag (1 = Blue, 2 = Red.
F9	Casualty fraction from a selected casualty fraction table.
K1	Element victim tabulator.
L(I)	Total chemical kills of element I for a unit.
M(I)	MOPP status for unit I (1 = Not in MOPP, 2 = in MOPP).
M1	Mission input selection.
M9(I,J)	Casualty fraction of element I with target radius J for assessing a unit in the maneuver profile.
N(I)	Unit status parameter (see App A).
N1	Number of units to be chemically assessed.
N2	Number of elements times fraction targeted.
P1	Force type of unit from N(24) of unit file (See App A).
R1	Target radius selected from table T9 and divided by 100 to be used as a subscript to determine F9.
R9(I,J)	Casualty fraction of element I with target radius J for assessing a unit in the reserve profile.
T1	Target identification number pointing to unit number for chemical assessment.
T9 (I,J)	Target radii (100, 200, 300, 400, 500 meters) based on unit type I and mission profile J.
U(I)	Unit number to be chemically assessed for target I.
U1	Unit type indicator. See App A, element 24.

b. File Structure Used (All on Disk #0).

Name	Type	# Rec/Length	Remarks
BLTEMP	Random	1/370	Table of target radii (100, 200, 300, 400, 500 meters) for the ten Blue unit types based on the four mission profiles (See element 24 and 21 of App A).
RDTEMP	Random	1/370	Same as above except for Red unit types.
BLCHMVCTM	Random	1/100	Accumulation table of ten Blue element types killed by chemicals only. (See N(1) - N(10) of unit file).
RDCHMVCTM	Random	1/100	Same as above except for Red element types.
Casualty fraction Tables 1-32	Random	1/460	Casualty fraction table for 10 weapons systems based on firer type and unit mission.

The follow acronym convention was used in naming the 32 casualty fraction tables:

(a) Mission firer — BTY - Battery; BN - Battalion

(b) Chemical Agent fired — PS - Persistent; NP - Non-persistent

(c) BL - Blue Force; RD - Red Force

(d) Target Profile — ATK - Attack; DFN - Defend; RS - Reserve; MV - Move

(e) Example: The file BTYPSRDATK denotes a battery of persistent agent fired at a red unit in an attack mission.

c. Data Used.

Data	Location	Remarks
Target Radii for Blue and Red units	BLTEMP/ RDTEMP	Derived from JIFFY chemical methodology (classified)
Casualty fractions for systems 1-10	Casualty fraction tables 1-32	Derived from classified agent data. (Classified) See methodology section.

```
100 REM-'F3' IS THE DAME CHEMICAL ASSESSMENT MODULE
110 DIM Z$(300),U(10),F(10),A(10),M(10),N(34),T9(10,4)
120 DIM A9(10,5),D9(10,5),R9(10,5),M9(10,5),C9(10),C(10),L(10)
130 PRINT @42:'L','                              CHEMICAL MODULE OUTPUT'
140 FOR I=1 TO 10
150 C(I)=0
160 NEXT I
170 PRINT
180 PRINT
190 PRINT
200 PRINT 'LCHEMICAL MODULE MENU--INPUT FOLLOWING OPTION:'
210 PRINT
220 PRINT '(1) RED BATTERY OF PERSISTENT'
230 PRINT '(2) RED BATTERY OF NON-PERSISTENT'
240 PRINT '(3) RED BATTALION OF PERSISTENT'
250 PRINT '(4) RED BATTALION OF NON-PERSISTENT'
260 PRINT '(5) BLUE BATTERY OF PERSISTENT'
270 PRINT '(6) BLUE BATTERY OF NON-PERSISTENT'
280 PRINT '(7) BLUE BATTALION OF PERSISTENT'
290 PRINT '(8) BLUE BATTALION OF NON-PERSISTENT'
300 PRINT '(9) EXIT CHEMICAL MODULE'
310 INPUT M1
320 GO TO M1 OF 360,360,360,360,400,400,400,400,2840
330 PRINT
340 PRINT 'IMPROPER ENTRY'
350 GO TO 200
360 OPEN 'BLTEMP';1,'R',Z$
370 GOSUB 2660
380 F1=1
390 GO TO 440
400 OPEN 'RDTEMP';1,'R',Z$
410 GOSUB 2660
420 F1=2
430 GO TO 440
440 GO TO M1 OF 450,540,630,720,810,900,990,1080
450 OPEN 'BTYPSBLDFN';1,'R',Z$
460 GOSUB 2460
470 OPEN 'BTYPSBLATK';1,'R',Z$
480 GOSUB 2510
490 OPEN 'BTYPSBLRS';1,'R',Z$
500 GOSUB 2560
510 OPEN 'BTYPSBLMV';1,'R',Z$
520 GOSUB 2610
530 GO TO 1170
540 OPEN 'BTYNPBLDFN';1,'R',Z$
550 GOSUB 2460
560 OPEN 'BTYNPBLATK';1,'R',Z$
570 GOSUB 2510
580 OPEN 'BTYNPBLRS';1,'R',Z$
590 GOSUB 2560
600 OPEN 'BTYNPBLMV';1,'R',Z$
610 GOSUB 2610
```

```
620 GO TO 1170
630 OPEN "BNPSBLDFN";1,"R",Z$
640 GOSUB 2460
650 OPEN "BNPSBLATK";1,"R",Z$
660 GOSUB 2510
670 OPEN "BNPSBLRS";1,"R",Z$
680 GOSUB 2560
690 OPEN "BNPSBLMV";1,"R",Z$
700 GOSUB 2610
710 GO TO 1170
720 OPEN "BNNPBLDFN";1,"R",Z$
730 GOSUB 2460
740 OPEN "BNNPBLATK";1,"R",Z$
750 GOSUB 2510
760 OPEN "BNNPBLRS";1,"R",Z$
770 GOSUB 2560
780 OPEN "BNNPBLMV";1,"R",Z$
790 GOSUB 2610
800 GO TO 1170
810 OPEN "BTYPSRDDFN";1,"R",Z$
820 GOSUB 2460
830 OPEN "BTYPSRDATK";1,"R",Z$
840 GOSUB 2510
850 OPEN "BTYPSRDRS";1,"R",Z$
860 GOSUB 2560
870 OPEN "BTYPSRDMV";1,"R",Z$
880 GOSUB 2610
890 GO TO 1170
900 OPEN "BTYNPRDDFN";1,"R",Z$
910 GOSUB 2460
920 OPEN "BTYNPRDATK";1,"R",Z$
930 GOSUB 2510
940 OPEN "BTYNPRDRS";1,"R",Z$
950 GOSUB 2560
960 OPEN "BTYNPRDMV";1,"R",Z$
970 GOSUB 2610
980 GO TO 1170
990 OPEN "BNPSRDDFN";1,"R",Z$
1000 GOSUB 2460
1010 OPEN "BNPSRDATK";1,"R",Z$
1020 GOSUB 2510
1030 OPEN "BNPSRDRS";1,"R",Z$
1040 GOSUB 2560
1050 OPEN "BNPSRDMV";1,"R",Z$
1060 GOSUB 2610
1070 GO TO 1170
1080 OPEN "BNNPRDDFN";1,"R",Z$
1090 GOSUB 2460
1100 OPEN "BNNPRDATK";1,"R",Z$
1110 GOSUB 2510
1120 OPEN "BNNPRDRS";1,"R",Z$
1130 GOSUB 2560
1140 OPEN "BNNPRDMV";1,"R",Z$
```

```
2210 IMAGE 3X,3D,11X,1D.2D,11X,2D,8X,1D
2220 A$='BLUE'
2230 IF F1=1 THEN 2250
2240 A$='RED'
2250 PRINT @42:
2260 PRINT @42:A$;' CHEMICAL VICTIMS FOR THIS MISSION'
2270 PRINT @42: USING 2280:C
2280 IMAGE 10(2X,4D.1D)
2290 OPEN 'BLCHMVCTM';1,'F',Z$
2300 READ #1,1:C9
2310 A$='BLUE'
2320 IF F1=2 THEN 2350
2330 GOSUB 2710
2340 WRITE #1,1:C9
2350 CLOSE
2360 GOSUB 2750
2370 OPEN 'RDCHMVCTM';1,'F',Z$
2380 READ #1,1:C9
2390 A$='RED'
2400 IF F1=1 THEN 2430
2410 GOSUB 2710
2420 WRITE #1,1:C9
2430 CLOSE
2440 GOSUB 2750
2450 GO TO 140
2460 FOR I=1 TO 10
2470 READ #1,I:D9(I,1),D9(I,2),D9(I,3),D9(I,4),D9(I,5)
2480 NEXT I
2490 CLOSE
2500 RETURN
2510 FOR I=1 TO 10
2520 READ #1,I:A9(I,1),A9(I,2),A9(I,3),A9(I,4),A9(I,5)
2530 NEXT I
2540 CLOSE
2550 RETURN
2560 FOR I=1 TO 10
2570 READ #1,I:R9(I,1),R9(I,2),R9(I,3),R9(I,4),R9(I,5)
2580 NEXT I
2590 CLOSE
2600 RETURN
2610 FOR I=1 TO 10
2620 READ #1,I:M9(I,1),M9(I,2),M9(I,3),M9(I,4),M9(I,5)
2630 NEXT I
2640 CLOSE
2650 RETURN
2660 FOR I=1 TO 10
2670 READ #1,I:T9(I,1),T9(I,2),T9(I,3),T9(I,4)
2680 NEXT I
2690 CLOSE
2700 RETURN
2710 FOR I=1 TO 10
2720 C9(I)=C9(I)+C(I)
2730 NEXT I
```

```
2740 RETURN
2750 PRINT @42:
2760 PRINT @42:"TOTAL ";A$;" CHEMICAL VICTIMS"
2770 PRINT @42: USING 2280:C9
2780 RETURN
2790 PRINT
2800 PRINT "UNIT   ";U(I)
2810 PRINT USING 2820:N
2820 IMAGE 3[10[4D.1D,1X],/],4[4D.1D,1X]
2830 RETURN
2840 OLD "DAME"
2850 END
```

7. Logistics Program. This program (Program 4 on the DAME menu) computes consumption of ammunition and fuel and calculates status levels for combat vehicle fuel and ammunition and computes the amount of spare supplies available to the unit.

a. Variable listing.

A	Ammunition consumption rates by mission (array)
A0	Total amount of ammunition on hand
A1	Amount of vehicle ammunition on hand
A2	Amount of stored ammunition on hand
A9	Unit ammunition requirement (full capacity)
C	Unit fuel/ammunition consumption (array)
F	Fuel consumption rates by mission (array)
F0	Total amount of fuel on hand
F1	Amount of vehicle fuel on hand
F2	Amount of stored fuel on hand
F9	Unit fuel requirement (full capacity)
N	Unit status variable (see App A)
S	Vehicle fuel/ammunition capacity
T	Amount of fuel/ammunition available on cargo vehicle (intermediate value)
W	Fuel and cargo vehicle capacity

b. File Structure Used (All on Disk #1).

Name	Type	# Rec/Length	Remarks
UNITFILE	Random	120/340	Unit Status file (see App A).

c. Data Requirements.

Data	Location	Remarks
Vehicle capacity	Array S	Derived from unclassified data
Cargo capacity	Array W	Derived from unclassified data
Ammunition consumption by mission	Array A	Classified data
Fuel consumption by mission	Array F	Classified data

```
100 REM-'P4'IS THE LOGISTICS MODULE FOR DAME
110 INIT
120 DIM N(34),A(9,11),F(9,11),C(2),S(2,11),W(2)
130 OPEN 'UNITFILE';1,'F',Z$
140 REM-READ BLUE CONSUMPTION DATA
150 GOSUB 1050
160 PRINT 'LLOGISTICS MODULE IS EXECUTINGG'
170 REM-COMPUTE CONSUMPTION
180 FOR I=1 TO 119
190 IF I<>41 THEN 220
200 REM-READ RED DATA
210 GOSUB 1360
220 C=0
230 ON EOF (1) THEN 250
240 READ #1,I:N
250 IF N(34)=0 THEN 910
260 IF N(13)=0 THEN 910
270 M=INT(N(13))
280 IF M=0 THEN 300
290 GOSUB 950
300 M=(N(13)-INT(N(13)))*10
310 IF M=0 THEN 330
320 GOSUB 950
330 N(20)=C(1)+N(31)
340 N(19)=C(2)+N(32)
350 N(30)=N(9)
360 REM-CALCULATE THE AMOUNT OF FUEL/AMMO ON HAND
370 F1=INT(N(25))
380 F2=(N(25)-F1)*1000000
390 F0=F1+F2+N(18)
400 A1=INT(N(26))
410 A2=(N(26)-A1)*100000
420 A0=A1+A2+N(17)
430 F0=F0-N(20)
440 A0=A0-N(19)
450 IF F0>0 THEN 470
460 F0=0
470 IF A0>0 THEN 490
480 A0=0
490 REM-ALLOCATE FUEL/AMMO AND CALCULATE STATUS
500 REM-     CALCULATE REQUIRED AMOUNT
510 A9=0
520 F9=0
530 FOR J=1 TO 10
540 IF J=7 AND (N(24)=1.1 OR N(24)=2.1) THEN 580
550 F9=F9+N(J)*S(1,J)
560 A9=A9+N(J)*S(2,J)
570 GO TO 600
580 F9=F9+N(J)*S(1,11)
590 A9=A9+N(J)*S(2,11)
600 NEXT J
610 REM-CALCULATE VEHICLE LOADS AND TKR/CARGO LOADS
```

```
620 T=F0-F9
630 IF T>0 THEN 660
640 N(25)=INT(F0)
650 GO TO 710
660 N0=N(9)*N(27)*W(1)
670 IF N0=0 THEN 640
680 IF T<N0 THEN 700
690 T=N0
700 N(25)=INT(F9)+T/1000000
710 T=A0-A9
720 IF T>0 THEN 750
730 N(26)=INT(A0)
740 GO TO 800
750 N0=(N(9)-N(9)*N(27))*W(2)
760 IF N0=0 THEN 730
770 IF T<N0 THEN 790
780 T=N0
790 N(26)=INT(A9)+T/100000
800 REM-CALCULATE VEHICLE STATUS
810 IF F9=0 THEN 840
820 N(15)=INT(N(25))/F9
830 GO TO 850
840 N(15)=0
850 IF A9=0 THEN 880
860 N(16)=INT(N(26))/A9
870 GO TO 890
880 N(16)=0
890 ON EOF (1) THEN 910
900 WRITE #1,I:N
910 NEXT I
920 CLOSE
930 OLD 'DAME'
940 END
950 REM-COMPUTE CONSUMPTION
960 FOR J=1 TO 10
970 IF J=7 AND (N(24)=1.1 OR N(24)=2.1) THEN 1010
980 C(1)=C(1)+N(J)*F(M,J)
990 C(2)=C(2)+N(J)*A(M,J)
1000 GO TO 1030
1010 C(1)=C(1)+N(J)*F(M,11)
1020 C(2)=C(2)+N(J)*A(M,11)
1030 NEXT J
1040 RETURN
1050 REM-BLUE LOG DATA
1060 RESTORE 1080
1070 READ S
1080 DATA 500,175,175,95,0,105,125,248,78,80,325
1090 DATA 2.33,1.22,2.02,0.916,0.02,0,1.98,3.02,0,0,9.01
1100 RESTORE 1120
1110 READ A
1120 DATA 1,1,1,1,1,1,1,1,1,1,1
1130 DATA 1,1,1,1,1,1,1,1,1,1,1
1140 DATA 1,1,1,1,1,1,1,1,1,1,1
```

```
1150 DATA 1,1,1,1,1,1,1,1,1,1,1
1160 DATA 1,1,1,1,1,1,1,1,1,1,1
1170 DATA 1,1,1,1,1,1,1,1,1,1,1
1180 DATA 1,1,1,1,1,1,1,1,1,1,1
1190 DATA 1,1,1,1,1,1,1,1,1,1,1
1200 DATA 1,1,1,1,1,1,1,1,1,1,1
1210 RESTORE 1230
1220 READ F
1230 DATA 1,1,1,1,1,1,1,1,1,1,1
1240 DATA 1,1,1,1,1,1,1,1,1,1,1
1250 DATA 1,1,1,1,1,1,1,1,1,1,1
1260 DATA 1,1,1,1,1,1,1,1,1,1,1
1270 DATA 1,1,1,1,1,1,1,1,1,1,1
1280 DATA 1,1,1,1,1,1,1,1,1,1,1
1290 DATA 1,1,1,1,1,1,1,1,1,1,1
1300 DATA 1,1,1,1,1,1,1,1,1,1,1
1310 DATA 1,1,1,1,1,1,1,1,1,1,1
1320 RESTORE 1340
1330 READ W
1340 DATA 2500,8.3
1350 RETURN
1360 REM-READ RED DATA
1370 RESTORE 1390
1380 READ S
1390 DATA 265,122,76.6,76.6,0,58.1,76.6,137,95,66,225
1400 DATA 1.85,1.4,0.2,0.2,0.02,0.14,2.63,4.6,0,0,10.3
1410 RESTORE 1430
1420 READ A
1430 DATA 1,1,1,1,1,1,1,1,1,1,1
1440 DATA 1,1,1,1,1,1,1,1,1,1,1
1450 DATA 1,1,1,1,1,1,1,1,1,1,1
1460 DATA 1,1,1,1,1,1,1,1,1,1,1
1470 DATA 1,1,1,1,1,1,1,1,1,1,1
1480 DATA 1,1,1,1,1,1,1,1,1,1,1
1490 DATA 1,1,1,1,1,1,1,1,1,1,1
1500 DATA 1,1,1,1,1,1,1,1,1,1,1
1510 DATA 1,1,1,1,1,1,1,1,1,1,1
1520 RESTORE 1540
1530 READ F
1540 DATA 1,1,1,1,1,1,1,1,1,1,1
1550 DATA 1,1,1,1,1,1,1,1,1,1,1
1560 DATA 1,1,1,1,1,1,1,1,1,1,1
1570 DATA 1,1,1,1,1,1,1,1,1,1,1
1580 DATA 1,1,1,1,1,1,1,1,1,1,1
1590 DATA 1,1,1,1,1,1,1,1,1,1,1
1600 DATA 1,1,1,1,1,1,1,1,1,1,1
1610 DATA 1,1,1,1,1,1,1,1,1,1,1
1620 DATA 1,1,1,1,1,1,1,1,1,1,1
1630 RESTORE 1650
1640 READ W
1650 DATA 2110,6.6
1660 RETURN
```

8. <u>Detection Program</u>. This program (Program 5 on the DAME menu) generates the target detection list used in game operations.

a. Variable list.

D	Intermediate variable holding number for decomposition.
D1	Variable used in decomposition sub-routine.
D2	Unit detection flag 02 = (unit not found), 02 = 1 (unit found).
D7	Binominal probability of finding one element of a unit.
D8	Number of elements which must be found for unit detection.
E1(5,4)	Array containing fraction of elements in a unit available for detection when unit is one of four missions: I = 1: Personnel J = 1: Attack 2: Vehicle 2: Defend 3: Tanks/APC 3: Reserve 4: Artillery 4: None 5: Rockets
F8(5,10)	Intelligence threshold array containing fraction of elements which must be detected before unit detection can be assessed; I = 1 to 5: element categories. J = 1 to 10: unit types.
G3(3,6)	Array containing profiles of 3 sensor groups; I = 1 to 3 groups. J = 1 to 6 sensor groups. The array contains the number of sensors of type J in group I.
H2(5,5) to H6(5,5)	Same structure as array H1, arrays H2 through H6 contain detection probabilities for sensor 2 through 6.
J1	Fraction of message jammed by EW. User input
K8	Target element parameter: 1 = Personnel 2 = Vehicles 3 = Tanks/APC 4 = Artillery 5 = Rockets
M	Major unit mission: 1 = Attack 2 = Defend 3 = Reserve 4 = Move
M9	Probability of element detection.
N(35)	Array holding current UNITFILE record.
N1	Number of 3 hour segments for this option.
O1	Variable containing 1 to 8 user selected DAMED options.
P1(10,5)	Array containing POTA detection probability for 10 units in 5 zones where I = 1 to 10 target units and J = 1 to 5 zones.

P7(10)	Contains the probability of detection for 10 units under one of the following searches: Blue battalion, Red regiment, Red commander.
P9(5)	The cumulative probability of detecting individual target element types by all sensors in a group covering the I = 1 to 5 target element types.
Q1,Q2	Values returned from decomposition subroutine where Q1 = integer part of the packed data and Q2 = fractional part of the packed data.
R2	Random number seed for the acquisition portion of DAMED.
S1	Blue or Red detection flag where S1 = 1 if Blue is detecting Red and S1 = 2 if Red is detecting Blue.
S8(3,6)	Array containing sensor groups profile where I = 1 to 3 groups and J = 1 to 6 sensors. S (I, J) contains the number of type J in sensor group I.
S5	Saved variable for sensor group covering this unit.
T2(5)	Total elements in a unit of type I = 1 to 5 elements of personnel, vehicles, tanks, artillery and rockets.
T5	Number of element categories in this unit containing elements.
T6	Number of element categories detected.
X1	Using normal approximating binominal for detecting particular element category.
X	Normalized random variable n (0,1) for approximating the binominal.

b. File Structures Used. (All on Drive #0).

Name	Type	#Rec/Length	Remarks
REDPOTA	Random	10/46	POTA for Red sensors detecting Blue.
BLUPOTI	Random	10/46	POTA for Blue sensors detecting Red.
RFLEE	Random	1/91	Red unit movement profiles.
BFLEE	Random	1/91	Blue movement profiles.
BLBDG	Random	1/91	Detection probabilities for Blue units in contact.
RDBDE	Random	1/91	Detection probabilities for Red units in contact.
RDCDR	Random	1/91	Detection probabilities for Red air reconnaissance.

BSENPRD	Random	3/55	Blue sensor group profiles.
RSENPRD	Random	3/55	Red sensor group profiles.
RS1T06	Random	30/55	Detection probabilities for Red sensors on Blue systems.
BS1T06	Random	30/55	Detection probabilities for Blue sensors on Red systems.
BTHOLD	Random	10/46	Blue threshold detection percentages.
RTHOLD	Random	10/46	Red threshold detection percentages.
BEI	Random	1/46	Blue sensor profile data.
REI	Random	1/46	Red sensor profile data.

c. Data Requirements.

Data	Location	Remarks
POTA data for Red sensors detecting Blue units	BLUPOT1	Derived from TAS II study (classified)
POTA data for Blue sensors detecting Red units	REDPOTA	From TAS II (classified)
Target movement data	BFLEE (for Blue) BFLEE (for Red)	See Table 8-4
Detection probabiltiies of sensors detecting target classes	BS1T06 RS1T06	From TAS II (classified)
Target recognition thresholds	LBTHOLD (for Blue) LRTHOLD (for Red)	From TAS II (classified)
Sensor profile data	BEI (for Blue) REI (for Red)	From TAS II (classified)
Sensor data for close-in target detectin of systems 1-10	RDCOR (for Red air RDBDE (for Red ground recon) BLBDG (for Blue ground recon)	From TAS II (classified)

```
100 REM-'P5'IS THE ACQUISITION PROGRAM FOR DAME
110 INIT
120 DIM P1(10,5),N(34),F(10),P7(10),Z$(300),H6(5,5),F8(5,10),H5(5,5)
130 DIM G3(3,6),P9(5),T2(5),E1(5,4),H1(5,5),H2(5,5),H3(5,5),H4(5,5)
140 REM SET RANDOM NUMBER SEED
150 PRINT 'LTHIS IS THE DAME ACQUISITION PROGRAM'
160 PRINT 'INPUT THE RANDOM NUMBER SEED FOR DETECTIONS'
170 INPUT R5
180 PRINT 'LSELECT ONE OF THE FOLLOWING OPTIONS'
190 PRINT 'BEGIN GAME FOR BLUE-1'
200 PRINT 'BEGIN GAME FOR RED-2'
210 PRINT 'UPDATE CURRENT LIST AT BEGINNING OF CI BLUE-3'
220 PRINT 'UPDATE CURRENT LIST AT BEGINNING OF CI RED-4'
230 PRINT 'UPDATE BLUE INEL FOR BLUE IN CONTACT-5'
240 PRINT 'UPDATE RED INTEL FOR   RED IN CONTACT-6'
250 PRINT 'UPDATE RED INTEL FOR RED CMDR VERIFICATION-7'
260 PRINT 'STOP RUN-8'
270 PRINT 'INPUT OPTION '
280 INPUT O1
290 IF O1=8 THEN 4740
300 GOSUB O1 OF 330,330,330,330,2530,2530,2530
310 GO TO 180
320 REM LOAD THE PROPER POTA TABLE
330 GO TO O1 OF 550,650,350,450
340 REM BLUE CI UPDATE
350 OPEN 'BS1TO6';1,'R',Z$
360 GOSUB 3390
370 OPEN 'RE1';1,'R',Z$
380 GOSUB 3660
390 OPEN 'BTHOLD';1,'R',Z$
400 GOSUB 3720
410 OPEN 'BSENPRO';1,'R',Z$
420 GOSUB 3780
430 GO TO 550
440 REM RED CI UPDATE
450 OPEN 'RS1TO6';1,'R',Z$
460 GOSUB 3390
470 OPEN 'BE1';1,'R',Z$
480 GOSUB 3660
490 OPEN 'RTHOLD';1,'R',Z$
500 GOSUB 3720
510 OPEN 'RSENPRO';1,'R',Z$
520 GOSUB 3780
530 GO TO 650
540 REM BEGIN GAME FOR BLUE LOAD RED POTA
550 OPEN 'REDPOTA';1,'R',Z$
560 GOSUB 3150
570 OPEN 'RFLEE';1,'R',Z$
580 GOSUB 3270
590 REM SET FLAG FOR RED
600 S1=1
610 L6=41
```

```
620 L7=119
630 GO TO 740
640 REM BEGIN GAME FOR RED LOAD BLUE POTA
650 OPEN 'BLUPOT1';1,'R',Z$
660 GOSUB 3150
670 OPEN 'BFLEE';1,'R',Z$
680 GOSUB 3270
690 REM SET FLAG FOR BLUE
700 S1=2
710 L6=1
720 L7=40
730 REM OPEN DAME UNIT FILE
740 OPEN 'UNITFILE';1,'F',Z$
750 IF O1<3 THEN 780
760 N1=6
770 GO TO 800
780 PRINT 'INPUT NUMBER OF HRS OF INTEL NEEDED MUST BE MYP OF 3'
790 INPUT N1
800 N1=N1/3
810 J=0
820 PRINT 'INPUT FRACTION OF SENSOR MESSAGES JAMMED'
830 INPUT J1
840 REM SET TIME LOOP FOR DETECTIONS
850 FOR T=1 TO N1
860 REM SET UNIT RECORD LOOP
870 FOR J=L6 TO L7
880 D1=1
890 REM       RETRIEVE RECORD FOR UNIT TO BE DETECTED
900 READ #1,J:N
910 REMPRINT 'AT 860 ';J;S1;N(14);N(21);N(22);N(12)
920 IF S1=INT(N(24)) OR N(34)=0 THEN 2180
930 REM CHECK FOR LOST TARGET
940 IF N(14)<0.29 OR N(14)>0.31 THEN 970
950 N(14)=0
960 REM CHECK FOR TARGET COVERAGE BY SOME SENSOR GROUP
970 D=N(22)
980 GOSUB 3340
990 S5=Q2
1000 Z5=Q1
1010 IF S5<>0 THEN 1110
1020 REM TARGET NOT COVERED BY SENSOR
1030 D=N(14)
1040 GOSUB 3340
1050 IF Q2=1 OR Q2=2 THEN 1710
1060 REM TARGET NOT PREVIOUSLY DETECTED OR IN LOST STATUS
1070 N(14)=0
1080 N(12)=0
1090 GO TO 2160
1100 REM TARGET UNDER SENSOR COVERAGE DECOMPOSE TIME
1110 D=N(14)
1120 GOSUB 3340
1130 REM CHECK FOR DETECTION STATUS
1140 IF Q2>0 THEN 1750
```

```
1150 REM SYSTEM NOT PREVIOUSLY DETECTED
1160 REM DECOMPOSE LOCATION AND PERFORM DETECTION
1170 REM FUNCTION
1180 REM SET UP POINTERS FOR PROPER POTA TABLE
1190 D=N(22)
1200 GOSUB 3340
1210 REM SAVE ZONE IN Z5 AND SAVE SENSOR GROUP IN S5
1220 Z5=Q1
1230 S5=Q2
1240 REM NOW SELECT UNIT TYPE
1250 D=N(24)
1260 GOSUB 3340
1270 REM MOVE TYPE TO Q2
1280 Q2=Q2+1
1290 REM MOVE ZONE BACK TO Q1
1300 Q1=Z5
1310 REM SELECT PROPER PROBABILITY FIRST RETRIEVE SENSOR
1320 IF S5<>0 THEN 1350
1330 PRINT "ERROR AT 1280";S5;Q1;N(22);N(24)
1340 STOP
1350 IF S5=4 OR Q1<3 THEN 1420
1360 GOSUB 3830
1370 D=N(24)
1380 GOSUB 3340
1390 IF D2=0 THEN 1680
1400 REM UNIT DETECTED
1410 GO TO 1520
1420 REM COVERED BY GENERAL GROUP
1430 P5=P1(Q2,Q1)
1440 R5=RND(R5)
1450 IF R5>P5 THEN 1680
1460 REM CHECK FOR EW INTERFERENCE
1470 R5=RND(R5)
1480 IF R5>1-J1 THEN 1680
1490 REM SYSTERM HAS BEEN DETECTED UPDATA FLEE
1500 REM TIME DETECTION STATUS AND
1510 REM MOVE TO NEW RECORD
1520 D=N(24)
1530 GOSUB 3340
1540 Q1=F(Q2+1)
1550 Q2=1
1560 IF D1=1 THEN 1630
1570 REM TARGET PREVIOUSLY DETECTED AND BEING TRACKED TAKE OLD STATUS
1580 S=Q1
1590 D=N(14)
1600 GOSUB 3340
1610 Q1=S
1620 REM COMPOSE NUMBER
1630 N(14)=Q1+Q2/10
1640 REM UPDATE TIME WATCHED
1650 N(12)=N(12)+3
1660 GO TO 2040
1670 REM UNIT HAS NOT BEEN DETECTED
```

```
1680 N(14)=0
1690 REM CHECK FOR LOST UNIT
1700 IF D1<2 THEN 1720
1710 N(14)=0.3
1720 N(12)=0
1730 GO TO 2160
1740 REM SYSTEM PREVIOUSLY DETECTED
1750 IF N(21)<>3 THEN 1800
1760 REM SYSTEM IS STATIONARY UPDATE TIME WATCHED
1770 N(12)=N(12)+3
1780 GO TO 2040
1790 REM CHECK FOR SYSTEM MOVING
1800 IF N(21)<>4 THEN 1890
1810 REM SYSTEM IS MOVING SET STATIONARY TIME
1820 REM TO ZERO AND TAKE OFF DETECTED LIST
1830 REM THEN TRY TO REDETECT
1840 D1=2
1850 GO TO 1190
1860 REM SYSTEM IS EITHER IN ATTACK OR DEFEND
1870 REM AND DETECTED. UPDATE FLEE TIME AND
1880 REM DETECT TIME
1890 N(12)=N(12)+3
1900 D=N(14)
1910 GOSUB 3340
1920 Q1=Q1-3
1930 IF Q1<=0 THEN 1990
1940 N(14)=Q1+Q2/10
1950 GO TO 2040
1960 REM   SYSTEM HAS MOVED TIME TO REDETECT
1970 REM SYSTEM FLEE TIME HAS EXPIRED SET DETECTION TO ZERO AND
1980 REM GO TO NEW RECORD
1990 N(12)=N(12)-3
2000 REM SUBTRACT FLEE TEME
2010 D1=2
2020 GO TO 1190
2030 REM CHECK ON VERIFICATION OF UNIT
2040 D=N(12)
2050 GOSUB 3340
2060 S3=Q1
2070 REM COMPARE TIME OF DETECT WITH FLEE TIME
2080 REM RETRIEVE FLEE TIME
2090 D=N(24)
2100 GOSUB 3340
2110 Q2=Q2+1
2120 IF S3<4 THEN 2160
2130 REM SYSTEM IS VERIFIED UPDATE FILE
2140 N(14)=INT(N(14))+0.2
2150 REM STORE UNIT RECORD
2160 WRITE #1,J:N
2170 REMPRINT "AT 2120";T;J;N(14);N(21);N(22);N(24);N(12)
2180 NEXT J
2190 NEXT T
2200 REM CLOSE UNIT FILE
```

```
2210 CLOSE
2220 GOSUB 2250
2230 RETURN
2240 REM PRINT THE LIST OF DETECTED UNITS
2250 OPEN 'UNITFILE';1,'F',Z$
2260 IF S1=2 THEN 2290
2270 PRINT 'LBLUE COMMANDER TARGET LIST'
2280 GO TO 2300
2290 PRINT 'LRED COMMANDER TARGET LIST'
2300 PRINT 'UNIT   DETECTION STATUS'
2310 FOR I=L6 TO L7
2320 READ #1,I:N
2330 IF S1=INT(N(24)) OR N(34)=0 THEN 2450
2340 D=N(14)
2350 GOSUB 3340
2360 REMPRINT 'AT 3585   Q1,Q2 ';Q1,Q2,I
2370 IF Q2=0 THEN 2450
2380 IF Q2=2 THEN 2420
2390 IF Q2=3 THEN 2440
2400 PRINT I,'DETECTED'
2410 GO TO 2450
2420 PRINT I,'**VERIFIED**'
2430 GO TO 2450
2440 PRINT I,'LOST'
2450 NEXT I
2460 INPUT L8
2470 CLOSE
2480 RETURN
2490 REM UPDATE BLUE INTELLIGENCE FOR BLUE IN CONTACT
2500 REM THIS SECTION OF CODE WILL ALLOW
2510 REM BLUE UNITS IN CONTACT TO UPDATE A BLUE
2520 REM UNIT COMMANDERS INTELLIGENCE MAP
2530 S1=1
2540 L6=41
2550 L7=119
2560 IF O1<6 THEN 2620
2570 S1=2
2580 L6=1
2590 L7=40
2600 IF O1=6 THEN 2620
2610 REMPRINT 'YOU HAVE CHOOSEN THE RED COMMANDER UPDATE'
2620 GO TO O1-4 OF 2640,2700,2760
2630 REM BLUE INTEL UNIT. LOAD BLUE DET PROB
2640 OPEN 'BLBDG';1,'R',Z$
2650 GOSUB 3310
2660 OPEN 'RFLEE';1,'R',Z$
2670 GOSUB 3270
2680 GO TO 2800
2690 REM RED INTEL UNIT LOAD RED BDE DETECTION PROBABILITIES
2700 OPEN 'RDBDE';1,'R',Z$
2710 GOSUB 3310
2720 OPEN 'BFLEE';1,'R',Z$
2730 GOSUB 3270
```

```
2740 GO TO 2800
2750 REM RED COMMANDERS INTELLIGENCE
2760 OPEN 'RDCOR';1,'R',Z$
2770 GOSUB 3310
2780 OPEN 'BFLEE';1,'R',Z$
2790 GOSUB 3270
2800 OPEN 'UNITFILE';1,'F',Z$
2810 IF S1=2 THEN 2840
2820 PRINT 'INPUT NUMBER OF RED UNITS CONTACTED'
2830 GO TO 2850
2840 PRINT 'INPUT NUMBER OF BLUE UNITS CONTACTED'
2850 INPUT N1
2860 FOR I=1 TO N1
2870 PRINT 'INPUT UNIT NUMBER'
2880 INPUT J
2890 READ #1,J:N
2900 IF S1<>INT(N(24)) AND N(34)<>0 THEN 2960
2910 REM UNIT IS SAME SIDE AS SEARCHER
2920 PRINT 'UNIT ';J;' IS ON SAME FORCE AS INTEL MAP'
2930 PRINT 'PLEASE INPUT CORRECT UNIT'
2940 GO TO 2880
2950 REM CHECK ON UNIT DETECTION
2960 D=N(24)
2970 GOSUB 3340
2980 R5=RND(R5)
2990 V2=Q2+1
3000 REMPRINT 'AT2880';J;R5;Q2;P7(V2)
3010 IF R5>P7(V2) THEN 3100
3020 REM UNIT IS ACQUIRED SET ACQUISITION AND FLEE TIME
3030 D=N(14)
3040 GOSUB 3340
3050 REM CHECK FLEE TIME
3060 IF Q1>F(V2) THEN 3080
3070 Q1=F(V2)
3080 N(14)=Q1+0.2
3090 WRITE #1,J:N
3100 NEXT I
3110 GOSUB 2260
3120 CLOSE
3130 RETURN
3140 REM READ OTA FROM UNIT 1
3150 FOR I=1 TO 10
3160 READ #1,I:P1(I,1),P1(I,2),P1(I,3),P1(I,4),P1(I,5)
3170 NEXT I
3180 CLOSE
3190 RETURN
3200 REM READ POTA2 FROM UNIT1
3210 FOR I=1 TO 10
3220 READ #1,I:P2(I,1),P2(I,2),P2(I,3),P2(I,4),P2(I,5)
3230 NEXT I
3240 CLOSE
3250 RETURN
3260 REM READ FLEE TIMES FROM UNIT 1
```

```
3270 READ #1,1:F
3280 CLOSE
3290 RETURN
3300 REM RETRIEVE THE SPECIAL VERIFICATION PROBABILITIES
3310 READ #1,1:P7
3320 CLOSE
3330 RETURN
3340 REM DECOMPOSE THE NUMBER D
3350 D8=ABS(D)
3360 Q1=INT(D8)
3370 Q2=(D8-Q1)*10
3380 RETURN
3390 FOR I=1 TO 5
3400 READ #1,I:H1(I,1),H1(I,2),H1(I,3),H1(I,4),H1(I,5)
3410 NEXT I
3420 J=6
3430 FOR I=1 TO 5
3440 READ #1,J:H2(I,1),H2(I,2),H2(I,3),H2(I,4),H2(I,5)
3450 J=J+1
3460 NEXT I
3470 FOR I=1 TO 5
3480 READ #1,J:H3(I,1),H3(I,2),H3(I,3),H3(I,4),H3(I,5)
3490 J=J+1
3500 NEXT I
3510 FOR I=1 TO 5
3520 READ #1,J:H4(I,1),H4(I,2),H4(I,3),H4(I,4),H4(I,5)
3530 J=J+1
3540 NEXT I
3550 FOR I=1 TO 5
3560 READ #1,J:H5(I,1),H5(I,2),H5(I,3),H5(I,4),H5(I,5)
3570 J=J+1
3580 NEXT I
3590 FOR I=1 TO 5
3600 READ #1,J:H6(I,1),H6(I,2),H6(I,3),H6(I,4),H6(I,5)
3610 J=J+1
3620 NEXT I
3630 CLOSE
3640 RETURN
3650 REM READ EXPOSURE ELEMENTS
3660 FOR I=1 TO 4
3670 READ #1,I:E1(1,I),E1(2,I),E1(3,I),E1(4,I),E1(5,I)
3680 NEXT I
3690 CLOSE
3700 RETURN
3710 REM READ THRESHOLD ELEMENTS
3720 FOR J=1 TO 10
3730 READ #1,J:F8(1,J),F8(2,J),F8(3,J),F8(4,J),F8(5,J)
3740 NEXT J
3750 CLOSE
3760 RETURN
3770 REM SENSOR PROFILE
3780 FOR I=1 TO 3
3790 READ #1,I:G3(I,1),G3(I,2),G3(I,3),G3(I,4),G3(I,5),G3(I,6)
```

```
3800 NEXT I
3810 CLOSE
3820 RETURN
3830 REM THIS DETERMINES THE PROBATILITY OF DETECTION FOR A UNIT
3840 REM SUM ELEMENTS IN UNIT ADJUSTED BY  PERCENT COVERED
3850 T2(1)=N(5)*N(29)
3860 T2(2)=(N(9)+N(10))*N(29)
3870 T2(3)=(N(1)+N(2)+N(3)+N(4)+N(6))*N(29)
3880 T2(4)=N(7)*N(29)
3890 T2(5)=N(8)*N(29)
3900 REM OBTAIN PROPER ZONE FOR UNIT
3910 D=N(22)
3920 GOSUB 3340
3930 REM SELECT UNIT MISSION
3940 M=N(21)
3950 REM CALCULATE PROB OF DETECTION OF THIS TARGET TYPE
3960 FOR K8=1 TO 5
3970 P9(K8)=1
3980 IF INT(T2(K8))<=0 THEN 4190
3990 REM CHECK ALL ELEMENTS BY   THIS GROUP
4000 T4=INT(T2(K8))
4010 FOR K9=1 TO 6
4020 REMPRINT 'AT3845';Q2;K9;G3(Q2,K9)
4030 IF G3(Q2,K9)=0 THEN 4180
4040 GO TO K9 OF 4050,4070,4090,4110,4130,4150
4050 M9=H1(K8,Q1)
4060 GO TO 4160
4070 M9=H2(K8,Q1)
4080 GO TO 4160
4090 M9=H3(K8,Q1)
4100 GO TO 4160
4110 M9=H4(K8,Q1)
4120 GO TO 4160
4130 M9=H5(K8,Q1)
4140 GO TO 4160
4150 M9=H6(K8,Q1)
4160 P9(K8)=P9(K8)*(1-(1-J1)*M9)^G3(Q2,K9)
4170 REMPRINT 'AT 3985 ';M9;J1
4180 NEXT K9
4190 P9(K8)=1-P9(K8)
4200 NEXT K8
4210 REM INDIVIDUAL PROBABILITIES ARE NOW IN P9 ATTEMPT TO DETECT
4220 T5=0
4230 T6=0
4240 REM SET UP UNIT TYPE
4250 D=N(24)
4260 GOSUB 3340
4270 U4=Q2+1
4280 FOR I8=1 TO 5
4290 IF T2(I8)<=0 THEN 4530
4300 T5=T5+1
4310 REM CALCULATE NUMBER OF ELEMENTS WHICH MUST BE DETECTED
4320 REMPRINT 'AT4124';I8;U4;F8(I8,U4);T2(I8);P9(I8);N(24),E1(I8,M),M
```

```
4330 IF P9(I8)<0.01 THEN 4530
4340 IF P9(I8)>0.99 THEN 4520
4350 REM Z8 IS INTELLIGENCE FACTOR IF TARGET HAS BEEN DELETED
4360 REM THEN Z8=FULL THRESHOLD IF TRACKING THEN Z8=.75
4370 Z8=1
4380 IF D1<>2 THEN 4400
4390 Z8=0.75
4400 D8=T2(I8)*F8(I8,U4)*E1(I8,M)*Z8
4410 REM SET MEAN AND STANDARD DEVIATION FOR NORMAL
4420 X1=T2(I8)*P9(I8)*E1(I8,M)
4430 S8=T2(I8)*P9(I8)*(1-P9(I8))*E1(I8,M)
4440 X=(D8-X1)/SQR(S8)
4450 REMPRINT 'AT4170';I8;U4;F8(I8,U4);T2(I8);P9(I8);S8;X;D8;X1
4460 GOSUB 4620
4470 REM REGENERATE RANDOM NUMBER FOR PROBABILITY LIMIT IS IN D2
4480 R5=RND(R5)
4490 REM NOTE THAT D2 IS PROB OF N OR FEWER WE WANT N OR MORE HENCE
4500 IF R5<D2 THEN 4530
4510 REM UNIT ELEMENTS DETECTED
4520 T6=T6+1
4530 NEXT I8
4540 REM IF 1/2 OF DETECTED THEN UNIT DETECTED
4550 D2=0
4560 REM RINT 'AT4270';T6;T5
4570 IF T6=0 AND T5=0 THEN 4600
4580 IF T6<T5/2 THEN 4600
4590 D2=1
4600 RETURN
4610 REM THIS IS THE NORMAL APPROX FOR DETECTIONS
4620 IF ABS(X)>20 THEN 4700
4630 T8=1/(1+0.2316419*ABS(X))
4640 D2=T8*(0.31938153+T8*(-0.356563782+1.781477937*T8))
4650 D2=D2+T8^4*(-1.821255978+1.330274429*T8)
4660 D2=SQR(1/(2*PI))*EXP(-X*X/2)*D2
4670 T8=10^(5+INT(-LGT(D2)))
4680 D2=INT(T8*D2+0.5)/T8
4690 GO TO 4710
4700 D2=0
4710 IF X<0 THEN 4730
4720 D2=1-D2
4730 RETURN
4740 PRINT 'LTHE RANDOM SEED FOR NEXT RUN IS ';R5
4750 INPUT L8
4760 OLD 'DAME'
4770 END
```

9. Game Turn Summary Program. This program (Program 6 on the DAME menu) performs all summary calculations at the end of a game turn. Operations performed include: logistics update and status check, update of killer-victim matrices, calculation of unit effectiveness, posting of the game history file, and output of unit status files and games work copies.

a. Variable listing.

A	Vehicle ammunition capacity in STONs (array)
A0	Total amount of ammunition on vehicles
A1	Amount of on board vehicle ammunition
A2	Amount of spare ammunition
C$,D$	Disk file identifiers
E$	Game turn number
F	Vehicle fuel capacity in gallons (array)
F0	Total amount of fuel on vehicles
F1	Amount of on-board fuel
F2	Amount of spare fuel
M$	Unit name
N	Unit status parameters (see App A) (array)
P1	Number of fuel tankers at start of game turn
P2	Number of ammunition trucks at start of game turn
Q,R	Red/Blue system losses to chemicals (array)
T1	Number of fuel tankers
T2	Number of ammunition trucks
U	TOE unit strength levels (array)
U0	Current unit cumulative firepower score
V	Equipment firepower score (array)
W$	Activity status code
X1,X2	Killer-victim matrices (array)

b. File Structures Used (Disk #0 unless noted otherwise).

Name	Type	#Rec/Length	Remarks
UNITFILE	Random	120/340	Unit status file (see App A)
TOEFILE	Random	120/110	Unit TOE equipment
CIDATA	Random	2/560	Killer-victim matrices
NAMEFILE	Random	120/15	Unit names
CI00-CI12	Random	120/340	Game turn unit history files (Disk #1)

KV00-KV12	Random	2/560	Game turn killer-victim matrices (Disk #1)
BLCHMVCTM	Random	1/100	Blue chemical victim file
RDCHMVCTM	Random	1/100	Red chemical victim file

c. Data Requirements.

Data	Location	Remarks
Vehicle ammunition capacity	Array A	Unclassified data
Vehicle fuel capacity	Array F	Unclassified data
Equipment firepower scores	Array V	Derived from JIFFY III data (classified)

```
100 REM-'P6' DOES GAME TURN UPDATES AND PRINTS RESULTS
110 INIT
120 IMAGE 1P,6[5[6D.6D,1X],/],4[6D.6D,1X]
130 DIM N(34),X1(6,10),X2(6,10),F(2,11),V(2,11),Q(10),R(10)
140 DIM C$(4),D$(4),E$(2),A(2,11),U(12),M$(8),W$(12),X(10),G$(1)
150 OPEN 'UNITFILE';1,'F',Z$
160 OPEN 'CIDATA';2,'F',Z$
170 OPEN 'TOEFILE';3,'F',Z$
180 OPEN 'NAMEFILE';4,'R',Z$
190 PRINT 'LCI SUMMARY PROGRAM'
200 PRINT 'J    ALL CI PROCESSING MUST BE COMPLETED PRIOR TO'
210 PRINT '    EXECUTING THIS PROGRAM.'
220 PRINT 'J    PUT DATA DISK IN DRIVE #1'
230 INPUT Z1
240 CALL 'MOUNT',1,Z$
250 PRINT 'JJENTER GAME NUMBER (1-9)'
260 INPUT G$
270 PRINT 'JENTER CI NUMBER (00-12)'
280 INPUT E$
290 B=VAL(E$)+1
300 C$='CI'&E$
310 D$='KV'&E$
320 UNIT 1
330 OPEN C$;8,'F',Z$
340 OPEN D$;9,'F',Z$
350 UNIT 0
360 REM-INITIALIZE
370 GOSUB 470
380 REM-UPDATE STAT. AND COPY TO HISTORY FILE
390 GOSUB 610
400 REM-UPDATE KV MATRICES
410 GOSUB 1330
420 REM-PRINT GAMER WORK COPY
430 GOSUB 1710
440 CLOSE
450 OLD 'DAME'
460 END
470 REM-INITIALIZE
480 RESTORE 500
490 READ V
500 DATA 1,1,1,1,1,1,1,1,1,1,1
510 DATA 1,1,1,1,1,1,1,1,1,1,1
520 RESTORE 540
530 READ A
540 DATA 2.33,1.22,2.02,0.916,0.02,0,1.98,3.02,0,0,9.01
550 DATA 1.85,1.4,0.2,0.2,0.02,0.14,2.63,4.6,0,0,10.3
560 RESTORE 580
570 READ F
580 DATA 500,175,175,95,0,105,125,248,78,80,325
590 DATA 265,122,76.6,76.6,0,58.1,76.6,137,95,66,225
600 RETURN
610 REM-UPDATE UNIT PARAMETERS AND WRITE FILE
```

```
620 PRINT @42:'LCI STATISTICS FOR GAME ';G$;'  CI ';E$
630 FOR I=1 TO 119
640 ON EOF (1) THEN 660
650 READ #1,I:N
660 ON EOF (3) THEN 700
670 READ #3,I:U
680 ON EOF (4) THEN 700
690 READ #4,I:M$
700 IF N(34)=0 THEN 1180
710 IF E$='00' THEN 1180
720 REM-UPDATE LOG STATS
730 F1=INT(N(25))
740 F2=(N(25)-F1)*1000000
750 A1=INT(N(26))
760 A2=(N(26)-A1)*100000
770 T1=N(9)*N(27)
780 T2=N(9)-T1
790 REM-UPDATE CBT VEH FUEL/AMMO O/HAND
800 F0=0
810 K=INT(N(24))
820 A0=0
830 FOR J=1 TO 10
840 IF J=7 AND (N(24)=1.1 OR N(24)=2.1) THEN 880
850 F0=F0+N(J)*F(K,J)*N(15)
860 A0=A0+N(J)*A(K,J)*N(16)
870 GO TO 900
880 F0=F0+N(J)*F(K,11)*N(15)
890 A0=A0+N(J)*A(K,11)*N(16)
900 NEXT J
910 REM-COMPUTE FUEL /AMMO ON HAND
920 P1=N(30)*N(27)
930 P2=N(30)-P1
940 IF F2>0 AND P1>0 THEN 970
950 C0=0
960 GO TO 980
970 C0=T1/P1*F2
980 N(25)=INT(F0)+C0/1000000
990 IF P2>0 AND A2>0 THEN 1020
1000 D0=0
1010 GO TO 1030
1020 D0=T2/P2*A2
1030 N(26)=INT(A0)+D0/100000
1040 REM-CALCULATE COMBAT EFFECTIVENESS
1050 U0=0
1060 K=INT(N(24))
1070 IF U(12)=0 THEN 1170
1080 Z0=(N(24)-INT(N(24)))*10
1090 FOR J=1 TO 10
1100 IF Z0=1 AND J=7 THEN 1130
1110 U0=U0+N(J)*V(K,J)
1120 GO TO 1140
1130 U0=U0+N(J)*V(K,11)
1140 NEXT J
```

```
1150 N(11)=U0/U(11)
1160 GO TO 1180
1170 N(11)=0
1180 REM-WRITE TO FILE
1190 ON EOF (1) THEN 1210
1200 WRITE #1,I:N
1210 UNIT 1
1220 ON EOF (8) THEN 1240
1230 WRITE #8,I:N
1240 UNIT 0
1250 REM-PRINT RECORD COPY
1260 GOSUB 2080
1270 NEXT I
1280 UNIT 1
1290 CLOSE 8
1300 UNIT 0
1310 CLOSE 3
1320 RETURN
1330 REM-UPDATE KV MATRICES
1340 OPEN 'BLCHMVCTM';6,'F',Z$
1350 OPEN 'RDCHMVCTM';7,'F',Z$
1360 ON EOF (2) THEN 1390
1370 READ #2,1:X1
1380 READ #2,2:X2
1390 ON EOF (6) THEN 1410
1400 READ #6,1:Q
1410 ON EOF (7) THEN 1430
1420 READ #7,1:R
1430 FOR I=1 TO 10
1440 X1(6,I)=X1(6,I)+R(I)
1450 X2(6,I)=X2(6,I)+Q(I)
1460 NEXT I
1470 UNIT 1
1480 ON EOF (9) THEN 1510
1490 WRITE #9,1:X1
1500 WRITE #9,2:X2
1510 CLOSE 9
1520 UNIT 0
1530 REM-PRINT KV MATRICES
1540 GOSUB 2550
1550 REM-ZERO OUT WORKING MATRICES
1560 X1=0
1570 X2=0
1580 R=0
1590 Q=0
1600 REM-WRITE TO FILE
1610 ON EOF (2) THEN 1640
1620 WRITE #2,1:X1
1630 WRITE #2,2:X2
1640 CLOSE 2
1650 ON EOF (6) THEN 1670
1660 WRITE #6,1:Q
1670 ON EOF (7) THEN 1690
```

```
1680 WRITE #7,1:R
1690 CLOSE 7
1700 RETURN
1710 REM-PRINT GAMER WORK COPY
1720 FOR I=1 TO 119
1730 ON EOF (1) THEN 1750
1740 READ #1,I:N
1750 ON EOF (4) THEN 1770
1760 READ #4,I:M$
1770 IF I=1 OR I=19 OR I=37 OR I=55 OR I=73 OR I=91 OR I=109 THEN 1800
1780 IF I=41 THEN 1800
1790 GO TO 1950
1800 REM-PRINT PAGE HEADER
1810 PRINT @42: USING 1820:'FOR CI ';B;'LOGISTICS';'INTEL';'STATUS'
1820 IMAGE 1P,7A,2D,26X,9A,18X,5A,17X,6A
1830 PRINT @42: USING 1840:'#';'UNIT';'TYPE';'MISSION','--RESUPPLY--'
1840 IMAGE 1X,1A,6X,4A,5X,4A,4X,7A,3X,12A,S
1850 PRINT @42: USING 1860:'DIST';'ZONE';'SENSOR';'FRA'
1860 IMAGE3X,4A,3X,4A,2X,6A,3X,3A,S
1870 PRINT @42: USING 1880:'MOPP';'STATE';'FRACTION'
1880 IMAGE 6X,4A,3X,5A,5X,8A,S
1890 PRINT @42: USING 1900:'SUPPLY PT'
1900 IMAGE 5X,9A
1910 PRINT @42: USING 1920:'AMMO';'POL';'KM';'GP';'COVER';'POL TK'
1920 IMAGE 35X,4A,4X,3A,5X,2A,12X,2A,4X,5A,23X,6A,S
1930 PRINT @42: USING 1940:'POL','AMMO'
1940 IMAGE 5X,3A,5X,4A
1950 PRINT @42: USING 1970:'|';'|';'|';'|'
1960 PRINT @42: USING 1970:'|';'|';'|';'|'
1970 IMAGE 24X,1A,30X,1A,22X,1A,16X,1A
1980 PRINT @42: USING 1990:I;M$;N(24);'|';N(13);N(17);N(18);N(28),'|'
1990 IMAGE 3D,3X,8A,3X,1D.2D,3X,1A,2X,1D.1D,4X,5D,2X,6D,3X,3D,2X,1A,S
2000 N2=INT(N(22))
2010 N3=(N(22)-N2)*10
2020 PRINT @42: USING 2030:N2,N3,N(29),'|',N(23),N(34),'|',N(27)
2030 IMAGE 3X,1D,6X,1D,5X,1D.2D,2X,1A,3X,1D,7X,1D,4X,1A,4X,1D.3D,S
2040 PRINT @42: USING 2050:N(31),N(32)
2050 IMAGE 3X,6D,3X,5D
2060 NEXT I
2070 RETURN
2080 REM-PRINT SUBROUTINE
2090 W$='INACTIVE'
2100 IF N(34)=0 THEN 2120
2110 W$='***ACTIVE***'
2120 READ #4,I:M$
2130 IF I=9 OR I=17 OR I=25 OR I=33 OR I=41 OR I=49 OR I=57 THEN 2170
2140 IF I=65 OR I=73 OR I=81 OR I=89 OR I=97 OR I=105 THEN 2170
2150 IF I=113 THEN 2170
2160 GO TO 2180
2170 PRINT @42:'L '
2180 PRINT @42: USING 2190:I;M$;N(24);'MISSION: ';N(13);'MOPP: ';N(23)
2190 IMAGE 2L,3D,2X,8A,3X,1D.2D,5X,10A,1D.1D,7X,6A,1D,10X,S
2200 PRINT @42: USING 2210:'STATUS: ';W$
```

```
2210 IMAGE 8A,12A
2220 PRI @42: USI 2230:"EQUIPMENT: ",N(1),N(2),N(3),N(4),N(5),N(6),N(7)
2230 IMAGE 16X,11A,1X,7[4D.1D,3X],S
2240 PRINT @42: USING 2250:N(8),N(9),N(10),"CBT EFF: ",N(11)
2250 IMAGE 3[4D.1D,3X],9A,1D.2D
2260 PRINT @42: USING 2270:"LOGISTICS: C/V STATUS:  POL-",N(15),"AMMO-"
2270 IMAGE 16X,28A,1D.2D,2X,5A,S
2280 PRINT @42: USING 2290:N(16),"RESUPPLY:  POL-",N(18),"AMMO-",N(17)
2290 IMAGE 1D.2D,3X,15A,6D,2X,5A,5D,3X,S
2300 PRINT @42: USING 2310:"CONSUME:  POL-";N(20);"AMMO-";N(19)
2310 IMAGE 14A,6D,2X,5A,5D
2320 N2=(N(25)-INT(N(25)))*1000000
2330 N3=(N(26)-INT(N(26)))*100000
2340 N4=N(9)*N(27)
2350 N5=N(9)-N4
2360 PRINT @42: USING 2370:"POL TKRS-";N4;"SPARE POL-";N2;"AMMO TRKS-"
2370 IMAGE 27X,9A,3D.1D,4X,10A,6D,8X,10A,S
2380 PRINT @42: USING 2390:N5;"SPARE AMMO-";N3
2390 IMAGE 3D.1D,4X,11A,5D
2400 N2=(N(14)-INT(N(14)))*10
2410 N2=N2+1
2420 GO TO N2 OF 2430,2450,2470,2490
2430 W$="NOT DETECTED"
2440 GO TO 2500
2450 W$="ACQUIRED"
2460 GO TO 2500
2470 W$="ACQ/VERIFIED"
2480 GO TO 2500
2490 W$="LOST"
2500 PRINT @42: USING 2510:"INTEL STATUS:";W$;"SENSOR FIELD:";N(22)
2510 IMAGE 16X,13A,2X,12A,3X,13A,2X,1D.1D,S
2520 PRINT @42: USING 2530:"SENSOR COVERAGE:";N(29);"POL FRA: ";N(27)
2530 IMAGE 5X,16A,2X,1D.2D,4X,9A,1D.3D
2540 RETURN
2550 REM-PRINT OUT KV MATRICES
2560 PRINT @42: USING 2570:"CI ";B-1;" BLUE KILLER-RED VICTIM TABLE"
2570 IMAGE 1P,3A,2D,   29A,2L
2580 PRINT @42: USING 2590:X1
2590 IMAGE 6[10[4D.1D,1X],/],1L
2600 X=0
2610 FOR I=1 TO 6
2620 FOR J=1 TO 10
2630 X(J)=X(J)+X1(I,J)
2640 NEXT J
2650 NEXT I
2660 PRINT @42: USING 2670:X,"CI TOTAL"
2670 IMAGE 1L,10[4D.1D,1X],3X,8A
2680 PRINT @42: USING 2690:"CI ";B-1;" RED KILLER-BLUE VICTIM TABLE"
2690 IMAGE 5L,3A,2D,29A,2L
2700 PRINT @42: USING 2590:X2
2710 X=0
2720 FOR I=1 TO 6
2730 FOR J=1 TO 10
```

```
2740 X(J)=X(J)+X2(I,J)
2750 NEXT J
2760 NEXT I
2770 PRINT @42: USING 2670:X,'CI TOTAL'
2780 RETURN
```

10. Air Loss Assessment Program. This program (Program 7 on the DAME menu) allows the input of losses to UNITFILE units without the requirement to run the attrition program.

a. Variable listing.

L(10)	System losses (1-10)
N(34)	Unit status parameters (See App A)
X1(6,10)	Blue killer - Red victim values
X2(6,10)	Red killer - Blue victim values

b. File Structures Used (all on Disk #0).

Name	Type	#Rec/Length	Remarks
UNIFILE	Random	120/340	Unit status file
CIDATA	Random	2/560	Killer-victim file

c. Date Required. None.

```
100 REM-'P7' ALLOWS INPUT OF OFF-LINE ASSESSMENTS TO UNITFILE
110 INIT
120 DIM N(34),X1(6,10),X2(6,10),L(10)
130 OPEN 'UNITFILE';1,'F',Z$
140 OPEN 'CIDATA';2,'F',Z$
150 ON EOF (2) THEN 180
160 READ #2,1:X1
170 READ #2,2:X2
180 PRINT 'LOFF-LINE LOSS ASSESSMENTS'
190 PRINT 'JENTER UNIT NUMBER'
200 INPUT I
210 L=0
220 K=2
230 IF I<40 THEN 250
240 K=1
250 ON EOF (1) THEN 270
260 READ #1,I:N
270 GO TO K OF 280,350
280 PRINT 'LBLUE KILLER-RED VICTIM'
290 PRINT USING 300:X1
300 IMAGE 6[10[4D.1D,1X],/]
310 PRINT 'JUNIT ';I;' CURRENT STATUS'
320 PRINT USING 330:N(1),N(2),N(3),N(4),N(5),N(6),N(7),N(8),N(9),N(10)
330 IMAGE 10[4D.1D,1X]
340 GO TO 390
350 PRINT 'LRED KILLER-BLUE VICTIM'
360 PRINT USING 300:X2
370 PRINT 'JUNIT ';I;' CURRENT STATUS'
380 PRINT USING 330:N(1),N(2),N(3),N(4),N(5),N(6),N(7),N(8),N(9),N(10)
390 PRINT 'JJENTER TYPE OF ATTRITION (1-6)'
400 INPUT T
410 IF T<1 OR T>6 THEN 390
420 PRINT 'ENTER ADDITIONAL LOSSES (1-10)'
430 INPUT L
440 GO TO K OF 450,500
450 FOR J=1 TO 10
460 N(J)=N(J)-L(J)
470 X1(T,J)=X1(T,J)+L(J)
480 NEXT J
490 GO TO 540
500 FOR J=1 TO 10
510 N(J)=N(J)-L(J)
520 X2(T,J)=X2(T,J)+L(J)
530 NEXT J
540 ON EOF (1) THEN 560
550 WRITE #1,I:N
560 PRINT 'JMORE LOSSES?   (Y OR N)'
570 INPUT Y$
580 IF Y$='N' THEN 600
590 GO TO 180
600 REM-WRITE KV FILE
610 ON EOF (2) THEN 640
```

```
620 WRITE #2,1:X1
630 WRITE #2,2:X2
640 CLOSE
650 PRINT 'LBLUE KILLER-RED VICTIMJ'
660 PRINT USING 300:X1
670 PRINT 'JJJRED KILLER-BLUE VICTIMJ'
680 PRINT USING 300:X2
690 INPUT J
700 OLD 'DAME'
710 END
```

11. Game Preparation Program. This program (Program 8 on the DAME menu) prepares the game history disk to record game data and initializes all files used in DAME to record game results.

a. Variable listing.

N	Unit status parameters (see App A)
X1,X2	Killer-victim matrices (6 X 10 array)
X	Loss tables for equipment types 1-10

b. File Structures Used (Disk #0 unless noted otherwise).

Name	Type	#Rec/Length	Remarks
CIDATA	Random	2/560	Killer-victim matrices
RDCHMVCTM	Random	1/100	Red chemical loss matrix
BLCHMVCTM	Random	1/100	Blue chemical loss matrix
CI00-CI12	Random	120/340	Game turn unit history files (drive #1)
KV00-KV12	Random	2/560	Game turn killer-victim matrices (drive #1)

c. Data Requirements. None.

```
100 REM-'P8' IS THE GAME PREPARATION MODULE
110 INIT
120 DIM N(34),X1(6,10),X2(6,10),E$(4),B$(27),C$(4),D$(2),X(10)
130 PRINT 'LGAME PREPARATION MODULE'
140 PRINT 'JJENTER GAME NUMBER (1-9):'
150 INPUT F$
160 PRINT 'INSURE AN EMPTY FORMATTED DISK IS IN DRIVE #1'
170 INPUT Z0
180 CALL 'MOUNT',1,Z$
190 B$='00010203040506070809101112'
200 REM-CREATE KV FILE
210 UNIT 1
220 FOR I=1 TO 13
230 D$=SEG(B$,I*2,2)
240 E$='KV'&D$
250 CREATE E$,'BU';2,600
260 OPEN E$;1,'F',Z$
270 PRINT E$
280 X1=0
290 X2=0
300 ON EOF (1) THEN 330
310 WRITE #1,1:X1
320 WRITE #1,2:X2
330 CLOSE 1
340 NEXT I
350 REM-CREATE HISTORY FILE
360 FOR I=1 TO 13
370 D$=SEG(B$,I*2,2)
380 C$='CI'&D$
390 PRINT C$
400 CREATE C$,'BU';120,310
410 OPEN C$;1,'F',Z$
420 FOR J=1 TO 119
430 N=0
440 ON EOF (1) THEN 460
450 WRITE #1,J:N
460 NEXT J
470 CLOSE 1
480 NEXT I
490 REM-ZERO OUT FILES
500 UNIT 0
510 OPEN 'CIDATA';1,'F',Z$
520 X1=0
530 X2=0
540 ON EOF (1) THEN 570
550 WRITE #1,1:X1
560 WRITE #1,2:X2
570 CLOSE 1
580 OPEN 'RDCHMVCTM';1,'F',Z$
590 X=0
600 ON EOF (1) THEN 620
610 WRITE #1,1:X
```

```
620 CLOSE 1
630 OPEN "BLCHMVCTM";1,"F",Z$
640 X=0
650 ON EOF (1) THEN 670
660 WRITE #1,1:X
670 CLOSE 1
680 PRINT "GAME ";F$;" FILES CREATED AND INITIALIZED"
690 INPUT ZO
700 CLOSE
710 OLD "DAME"
720 END
```

12. Game Postprocessor Program. This program (Program 9 on the DAME menu) computes game summary statistics for DAME. The summary statistics computed are:

Killer-victim tables
Movement distances for all Blue units
Consumption statistics
Resupply statistics
Unit effectiveness recapitulation by game turn
Total Blue/Red losses by system (1-10)

a. Variable listing.

C	Total systems available (array)
M$	Unit name
N	Unit status parameters (see App A)
R	Usage table for Blue (array)
TO	Total system kills (array)
T1,T2	Summary K-V matrices (array)
T9	Switching counter for summations
U	Blue unit effectiveness summary table (array)
X1, X2	Game turn K-V matrices (array)

b. File Structures Used. (Drive #0 unless noted otherwise).

Name	Type	#Rec/Length	Remarks
NAMEFILE	Random	120/15	Unit names
C100-C112	Random	120/340	Game turn unit histories (Drive #1)
KV00-KV12	Random	2/560	Game turn KV tables (Drive #1)

c. Data Requirements. None.

```
100 REM-'P9' IS THE GAME POSTPROCESSOR FOR DAME
110 INIT
120 DIM N(34),X1(6,10),X2(6,10),M$(8),R(40,5),S$(16),E$(2),F$(4)
130 DIM T1(6,10),T2(6,10),T0(10),R0(5),U(40,7),C(10)
140 OPEN 'NAMEFILE';2,'R',Z$
150 C=0
160 T1=0
170 T2=0
180 R=0
190 R0=0
200 T9=0
210 U=0
220 S$='0000010203040506'
230 PRINT 'LDAME POSTPROCESSOR'
240 PRINT 'JPUT GAME DISK IN DRIVE #1'
250 INPUT I
260 CALL 'MOUNT',1,Z$
270 PRINT 'JENTER GAME NUMBER (1-4)'
280 INPUT A
290 PRINT 'ENTER 1ST AND LAST CI TO BE PROCESSED (0-6)'
300 INPUT V,W
310 FOR I=V+1 TO W+1
320 E$=SEG(S$,1+2*I,2)
330 UNIT 1
340 F$='CI'&E$
350 OPEN F$;1,'R',Z$
360 PRINT F$
370 FOR J=1 TO 40
380 ON EOF (1) THEN 400
390 READ #1,J:N
400 IF N(34)=0 THEN 500
410 IF E$='00' THEN 470
420 R(J,1)=R(J,1)+N(28)
430 R(J,2)=R(J,2)+N(19)
440 R(J,3)=R(J,3)+N(20)
450 R(J,4)=R(J,4)+N(17)
460 R(J,5)=R(J,5)+N(18)
470 U(J,I)=N(11)
480 IF E$<>'00' THEN 500
490 GOSUB 1220
500 NEXT J
510 CLOSE 1
520 F$='KV'&E$
530 OPEN F$;1,'R',Z$
540 PRINT F$
550 ON EOF (1) THEN 580
560 READ #1,1:X1
570 READ #1,2:X2
580 T1=T1+X1
590 T2=T2+X2
600 CLOSE 1
610 NEXT I
```

```
620 FOR I=1 TO 40
630 FOR J=1 TO 5
640 RO(J)=RO(J)+R(I,J)
650 NEXT J
660 NEXT I
670 UNIT 0
680 REM-PRINT RESULTS
690 PRINT @42:'LGAME ';A;' RECAPITULATION'
700 PRINT @42:'JJFUEL/AMMO CONSUMPTION AND DISTANCE TRAVELLED'
710 PRINT @42: USING 720:'#','UNIT','KM','C/AMMO','C/FUEL'
720 IMAGE 1L,1X,1A,6X,4A,7X,2A,3X,6A,4X,6A,S
730 PRINT @42: USING 740:'R/AMMO','R/FUEL'
740 IMAGE 4X,6A,4X,6A
750 FOR I=1 TO 40
760 ON EOF (2) THEN 780
770 READ #2,I:M$
780 PRINT @42: USING 790:I,M$,R(I,1),R(I,2),R(I,3),R(I,4),R(I,5)
790 IMAGE 3D,3X,8A,3X,4D,3X,4[6D,4X]
800 NEXT I
810 PRINT @42: USING 820:'TOTAL',RO
820 IMAGE 2L,5A,10X,6D,3X,4[6D,4X]
830 PRINT @42:'LKILLER-VICTIM SUMMARY'
840 PRINT @42:'JJJBLUE KILLER-RED VICTIM'
850 PRINT @42: USING 860:T1
860 IMAGE 1L,6[10[5D.1D,2X],/]
870 GOSUB 1090
880 PRINT @42:'JJJRED KILLER-BLUE VICTIM'
890 PRINT @42: USING 860:T2
900 GOSUB 1090
910 PRINT @42: USING 920:C,'TOTAL AT GAME START'
920 IMAGE 2L,10[5D.1D,2X],3X,19A
930 PRINT @42:'LUNIT STATUS BY CIJJJ'
940 FOR I=1 TO 40
950 ON EOF (2) THEN 970
960 READ #2,I:M$
970 PRINT @42: USING 980:I,M$,U(I,1),U(I,2),U(I,3),U(I,4),U(I,5),U(I,6)
980 IMAGE 2D,3X,8A,3X,6[1D.2D,3X],S
990 PRINT @42: USING 1010:U(I,7)
1000 NEXT I
1010 IMAGE 1D.2D
1020 CLOSE 2
1030 PRINT 'JMORE GAMES?  (Y OR N)'
1040 INPUT Q$
1050 IF Q$='Y' THEN 140
1060 CLOSE
1070 OLD 'DAME'
1080 END
1090 REM-TOTAL KV
1100 TO=0
1110 IF T9=0 THEN 1130
1120 T1=T2
1130 FOR I=1 TO 10
1140 FOR J=1 TO 6
```

```
1150 TO(I)=TO(I)+T1(J,I)
1160 NEXT J
1170 NEXT I
1180 PRINT @42: USING 1190:TO,'GAME TOTAL'
1190 IMAGE 1L,10[5D.1D,2X],3X,10A
1200 T9=1
1210 RETURN
1220 REM-TOTAL UP SYSTEMS
1230 FOR K=1 TO 10
1240 C(K)=C(K)+N(K)
1250 NEXT K
1260 RETURN
```

13. TOE File Preparation Program. This program (Program 10 on the DAME menu) prepares TOE files for use in the UNITFILE. The program allows entry of unit data and calculates a unit firepower score for use in the unit effectiveness calculation.

a. Variable Listing.

F	Intermediate firepower score factor
S	Equipment firepower score (array)
U	U(1-10) Equipment types 1-10
	U(11) Unit firepower score
	U(12) Unit type ID

b. File Structures Used (All on disk #0).

Name	Type	#Rec/Length	Remarks
TOEFILE	Random	120/110	Holds equipment TOE files

c. Data Requirements.

Data	Location	Remarks
Firepower scores	Array S	Derived from JIFFY data (classified)

```
100 REM-'P10' BUILDS THE UNIT TOE REFERENCE FILE
110 INIT
120 DIM U(12),S(2,11)
130 OPEN 'TOEFILE';1,'F',Z$
140 RESTORE 160
150 READ S
160 DATA 1,1,1,1,1,1,1,1,1,1,1
170 DATA 1,1,1,1,1,1,1,1,1,1,1
180 PRINT 'LTOE FILE BUILDER'
190 PRINT 'DESIRED ACTION:  1-BUILD UNIT   2-DISPLAY UNIT   3-END'
200 INPUT Z1
210 PRINT 'L '
220 GO TO Z1 OF 230,440,520
230 PRINT 'ENTER: UNIT#, SIDE, UNIT TYPE   (999=STOP)'
240 INPUT I,K,L
250 IF I=999 THEN 190
260 U(12)=K+L/10
270 L=L+1
280 PRINT 'ENTER # OF SYSTEMS 1-10'
290 INPUT U(1),U(2),U(3),U(4),U(5),U(6),U(7),U(8),U(9),U(10)
300 F=0
310 FOR J=1 TO 10
320 IF L=2 AND J=7 THEN 350
330 F=F+U(J)*S(K,J)
340 GO TO 360
350 F=F+U(J)*S(K,11)
360 NEXT J
370 U(11)=F
380 REM -WRITE FILE
390 ON EOF (1) THEN 410
400 WRITE #1,I:U
410 PRINT USING 420:I,' - ',U
420 IMAGE 1L,3D,3A,10[4D,1X],2X,5D,2X,1D.1D
430 GO TO 230
440 PRINT 'ENTER UNIT #    (999=STOP)'
450 INPUT I
460 IF I=999 THEN 190
470 ON EOF (1) THEN 490
480 READ #1,I:U
490 PRINT USING 500:'UNIT';I;U
500 IMAGE 6A,3D,/,10[4D.1D,1X],/,6D,3X,1D.1D
510 GO TO 440
520 CLOSE 1
530 OLD 'DAME'
540 END
```

14. Sensor Group Preparation Program. This program (Program 11 on the DAME menu) enables the games to specify a unique mix of sensors for use in the detection program

a. Variable Listing.

S(6) Array of sensor types 1-6

b. File Structures Used (all on Disk #0).

Name	Type	#Rec/Length	Remarks
RSENPRO	Random	3/60	Red sensor composition for groups 1-3
BSENPRO	Random	3/60	Blue sensor composition for groups 1-3

c. Data Requirements. None.

```
100 REM-'P11' IS THE PROGRAM TO GENERATE NEW SENSOR GROUPS
110 INIT
120 DIM S(6),Z$(300)
130 PRINT 'LDAME SENSOR GROUP BUILDER.   SELECT ONE:'
140 PRINT 'BUILD BLUE SENSOR GROUPS-1'
150 PRINT 'BUILD RED SENSOR GROUPS-2'
160 PRINT 'DUMPFILES/STOP-3'
170 INPUT O1
180 GO TO O1 OF 190,300,410
190 PRINT 'LBUILDING BLUE  GROUPS'
200 OPEN 'BSENPRO';1,'F',Z$
210 FOR I=1 TO 3
220 PRINT 'INPUT NUMBER OF SENSORS OF EACH TYPE FOR GROUP ';I
230 PRINT 'GDRADAR,ARTRADAR,LRRP,SLAR,AF/IR,FO'
240 INPUT S(1),S(2),S(3),S(4),S(5),S(6)
250 WRITE #1,I:S
260 NEXT I
270 CLOSE
280 GO TO 130
290 REM BUILD RED GROUPS
300 PRINT 'LBUILDING RED SENSOR GROUPS'
310 OPEN 'RSENPRO';1,'F',Z$
320 FOR I=1 TO 3
330 PRINT 'INPUT NUMBER OF SENSORS OF EACH TYPE FOR GROUP ';I
340 PRINT 'GDRADAR,ARTRADAR,LRRP,RPV,SLAR,FO'
350 INPUT S(1),S(2),S(3),S(4),S(5),S(6)
360 WRITE #1,I:S
370 NEXT I
380 CLOSE
390 GO TO 130
400 REM CHECK FILES
410 PRINT 'LDUMPING SENSOR FILES'
420 OPEN 'BSENPRO';1,'F',Z$
430 PRINT 'BLUE'
440 PRINT 'GDRADAR,ARTRADAR,LRRP,SLAR,AF/IR,FO'
450 FOR I=1 TO 3
460 READ #1,I:S
470 PRINT 'GROUP ';I,S(1);S(2);S(3);S(4);S(5);S(6)
480 NEXT I
490 CLOSE
500 PRINT 'RED'
510 OPEN 'RSENPRO';1,'F',Z$
520 PRINT 'GDRADAR,ARTRADAR,LRRP,RPV,SLAR,FO'
530 FOR I=1 TO 3
540 READ #1,I:S
550 PRINT 'GROUP ';I,S(1);S(2);S(3);S(4);S(5);S(6)
560 NEXT I
570 INPUT Q
580 CLOSE
590 OLD 'DAME'
600 END
```

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